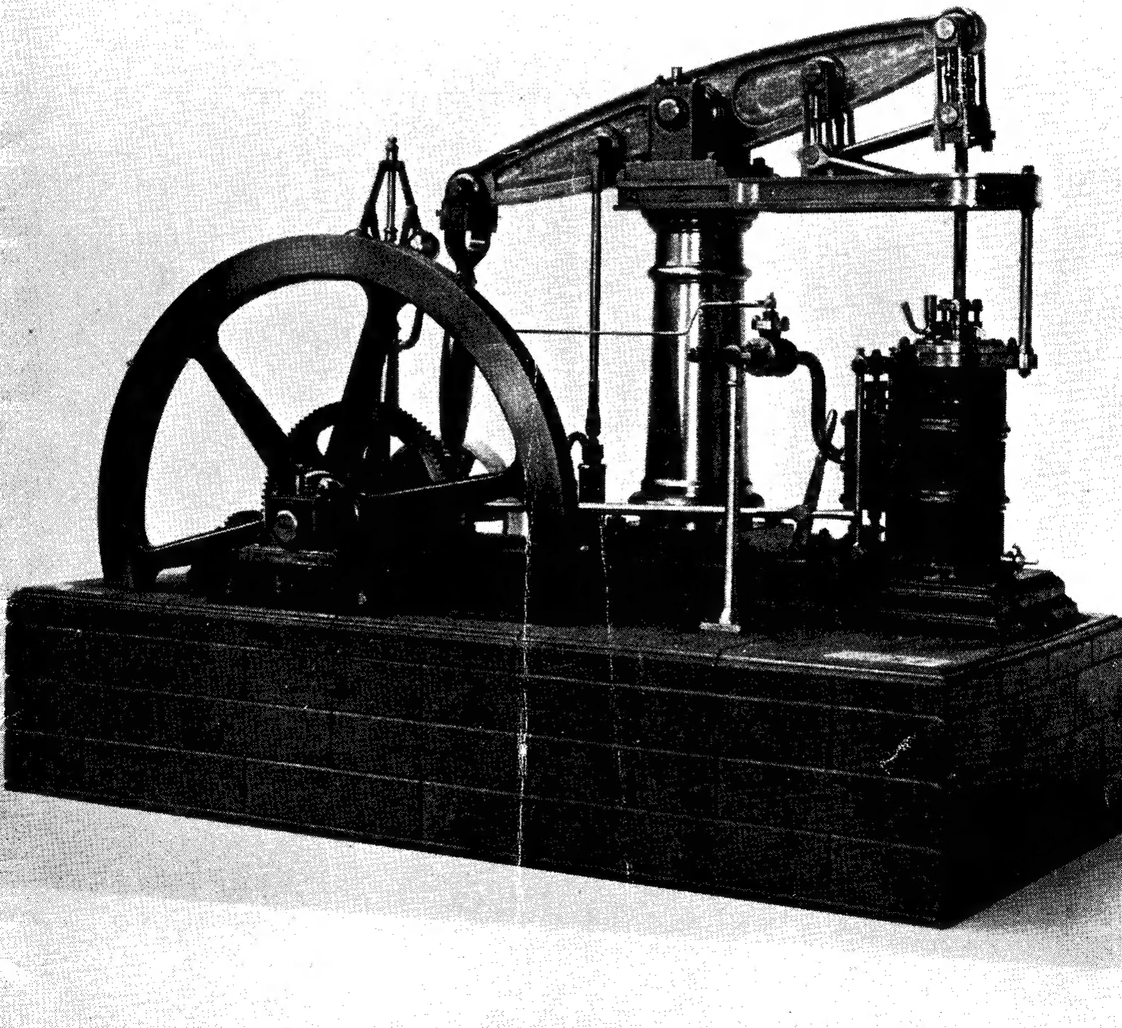
THE MODEL ENGINEER



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The MODEL ENGINEER

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SMOKE RINGS

Greetings

● THIS ISSUE bears the date of Christmas Day, and we take the opportunity to wish all readers, everywhere, a very happy time and all possible success to their model engineering activities in 1953. We hope, also, that this issue will give some enjoyment during the holiday, for we have managed to squeeze in one or two contributions in lighter vein. Also, this issue is the last of its volume as well as the last in the present format; from now on, the "M.E." will appear in a new dress—designed to give a brighter appearance to the magazine.

When Christmas is over, most people begin to think of the future, to put more effort into the task of finishing those models that are intended to run next summer, and to prepare for next year's "M.E." Exhibition. So far as we are concerned, the main task is to provide helpful, instructive articles and pictures to enable our readers' interests, problems and ambitions to be met; it is our pleasure to serve in this way, and we gratefully acknowledge the world-wide support that we enjoy.

Our Cover Picture

● THE FIRST examples of the practical use of steam power, beam engines in their various forms, have long been popular and worthy objects of model engineering interest. Now that full-sized engines of this type are rapidly becoming extinct, only the many models which have been made of them will remain to keep their memory alive, and for this reason, if no other, we have a special affection for good examples of such models. One of the most popular designs for a model beam engine ever published was that of the "M.E." beam engine, a centre-column engine of the 1840 period, described by Mr. George Gentry as far back as 1914, but still regarded as a classic example of its type. Some notable examples of this engine have been built within recent years, one of which by Mr. R. A. Barker, of Sheffield, won a bronze medal in the 1949 "M.E." Exhibition. The example shown in this photograph was entered in the 1952 Exhibition by Mr. L. J. Roe, of Twickenham, and was awarded a Very Highly Commended diploma. Another similar engine by Mr. G. Brook, of Brighouse, Yorks, in the same Exhibition, was awarded the Ferguson prize for the best stationary steam engine.

Index for Volume 107

● WE REGRET that we are not able to provide a bound-in index for the volume (107) which is completed with this issue, but we will send a copy to any reader who makes a special application for it.

We would be obliged, therefore, if every reader who really requires a copy will advise us immediately, enclosing an envelope large enough to take the "M.E." flat, stamped with a *three-halfpenny* stamp and addressed to himself. His copy of the index will be forwarded to him as soon as it is available.

"A Little Nonsense Now and Then—!"

● OUR CRITICS, alas! are always with us, and we have been severely castigated by one of our readers for our occasional lapses from the straight and narrow path of serious literature. We quote his letter verbatim: "I have noticed in recent years that your Christmas issue sometimes contains articles of a frivolous nature, a fact which I rather deplore. Model engineering is a *serious* business, and many of your readers will agree with me that the festive season should not be made an excuse for a lot of jokes which are of no practical use. I therefore beg to submit the enclosed illustrated instructional article with a view to inclusion in your next Christmas number. Yours faithfully, Michael Oxley."

Needless to say, we promptly accepted the article, and have included it in this week's issue, so that readers may be able to take to heart the valuable precepts expounded by this contributor. In the words of one of our famous regular contributors—"'Nuff sed!"

Australia Discovers A. A. Sherwood

● READERS MAY be interested to learn that Mr. A. A. Sherwood, so well known for his "Dot" series of speed boats, his ultra-miniature diesel engines and his "OO"-gauge, live-steam 2-10-10-2 Mallet compound locomotive, is now safely domiciled in Australia, since he has taken up a post as lecturer in mechanical engineering in the Sydney University. He arrived in Sydney on September 22nd, and on the evening of the next day called upon Mr. R. R. Steward, hon. secretary of the Sydney Society of Model Engineers. No time lost in ferreting out co-enthusiasts, obviously! But let Mr. Steward continue the story, as reported in the Sydney S.M.E. Bulletin, a copy of which has just reached us:—

"Is he (Sherwood) keen? Well, he called to see me on Tuesday night, September 23rd, accepted a membership form and returned on Saturday afternoon with the greatest array of small working models ever seen together at one time. Two diesel speed boats about 7 in. to 9 in. long; two flash steam speed boats of similar length; three diesel engines mounted with props, the middle size a one-fifteenth c.c., and the smallest a one-fortieth c.c., and two live steam locomotives, the larger of which is a model of a 2-10-10-2 Mallet in "OO"-gauge, 4 mm. scale.

"This locomotive is the most amazing model one could ever wish to see, every piece, and there are hundreds, hand-made, fabricated, etc.; it was originally fired by coal, but has now been converted to petrol blowlamps. THE MODEL ENGINEER published an article on this locomotive, December 7th, 1950, taking up seven pages, worth re-reading.

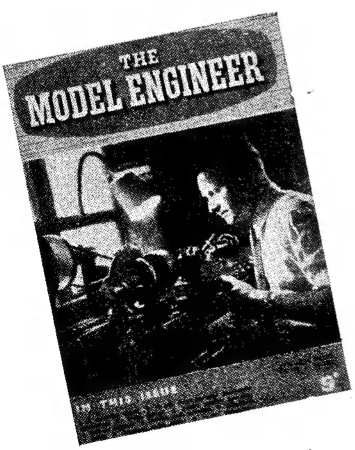
"Arthur kindly consented to provide the lecture for the evening, at the meeting, in lieu of Norm King, and discussed various problems that had occurred during the 2,000 hours construction of this locomotive, and his methods of overcoming them. I have no hesitation in saying that the entire 50-odd present provided the most interested audience that we've had up to date in the 'Bits and Pieces' session."

We can well believe it, and we are not surprised to learn that Sherwood "is going to be listed for "Bits and Pieces" about every second month, until he has described the building and operation of all his models.

Good luck to him!

Mr. H. P. Jackson

● WE REGRET to learn that Mr. H. P. Jackson, of 40, York Road, Haxby, Yorks, has lately suffered a serious misfortune. His workshop and most of its contents have been destroyed by fire; consequently, his customers may experience some delay in attention to their enquiries and orders. We are sure that our readers will join us in sympathising with Mr. Jackson in his catastrophe. We sincerely hope that he will soon be able to resume his normal business.



NEXT WEEK'S ISSUE OF

THE MODEL ENGINEER

● As recently announced, THE MODEL ENGINEER will, as from next week's issue, appear in a new enlarged form. The cover, a reproduction of which is shown opposite, will be in blue and black.

The demand for the first issue of the bigger "M.E." is certain to be very great, and to avoid disappointment readers are advised to order their copies now. Note—the price remains at 9d.!

A First Attempt

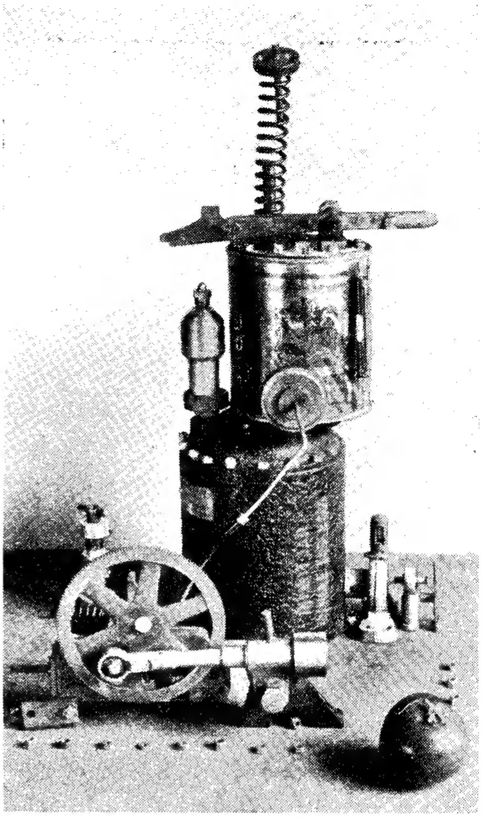
A Stationary Engine with Polygonal Cylinders

by Michael Oxley

BEING by profession a Turkish bath attendant I have for many years been fascinated by steam, and it has always been my ambition to build a steam engine that actually worked. The opportunity to do so having presented itself, I started by obtaining all the available blueprints of stationary engines, but on inspection they proved to be too elementary, so I decided to embark on a free-lance design. I thought it best not to bother with plans and drawings, as these might interfere with the free expression of ideas ; instead, I intended to build the engine up by making each piece separately and joining it on to the next.

A very good way to start a job like this is to see what materials can be got together, and a quick dive into the scrap-box produced two sets of lacerated knuckles and a fortnight in hospital with concussion. On my way home I managed to pick up one or two nice bits of stuff, brass bar, etc., and next day a start was made on the boiler.

The boiler was produced in a rather unorthodox manner, being bored from the solid. The first attempt was not a success, as owing to a setting error, the walls of the boiler were found to vary in thickness round the circumference. On one side it was 0.003 in. thick and on the other side it was nearly an inch and a quarter, so this one was thrown into the scrap-box and work started on another. All went well at first, but in the final stages the 3 in. diameter bar was inadvertently bored out to 3.001 in. resulting in the complete disappearance of eleven pounds of brass. Reflecting bitterly on the penalty of working to excessively fine limits, I chucked a third piece of bar in the four-jaw and started all over again. Being by this time somewhat weary of turning the saddle handwheel, I decided to try the automatic feed and I had just got this working nicely when my Aunt announced that dinner was ready, in the annoying way that Aunts have at such times. On returning to the workshop some two hours later I was horrified to find that a major disaster had occurred. This time not only was the work-piece gone, but most of the lathe as well, in fact only the bed and a large heap of swarf was left, so this was thrown into the scrap-box and another lathe procured. I was fortunate in obtaining a second-hand machine from the Woolwich Arsenal which had, I believe, once been used for turning pikes. It swung 4 in. in the gap and took 22 ft. between centres, which necessitated knocking a hole in the wall and running the tailstock end through our next door neighbour's sitting-room. Luckily, they had just bought a television set and so did not notice anything at the time.

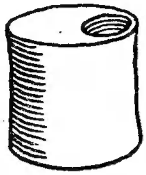


This is it ! A general view of the engine. The tomato has no technical significance, it was accidentally left there when the photograph was taken and actually formed part of the author's lunch

As the shortage of brass had now become national, I scrapped my original idea and decided that for my fourth attempt the boiler should be made out of an ordinary treacle tin. The treacle was first removed to prevent priming, and the lid soldered in position. Unfortunately, while this was being done, the bottom fell off, and as that was being replaced the lid came off again. This might have gone on for weeks had I not thought of a brilliant solution to the *impasse.* First of all I soldered the bottom on the top, then, balancing on my head, I very carefully soldered the top upside-down on the bottom.

I thought it would be a good idea to give the boiler a steam test before going any further ; accordingly, it was filled to the top with water and placed on the gas stove. Most boilers explode without warning, but this one proved to be superior in this respect. It rapidly assumed an almost spherical shape, giving me ample time to take cover under the sink. After repairs to the ceiling and window had been completed, work was started on the fifth boiler, and it was

decided to fit a safety-valve on this one. The safety-valve was quickly made out of odds and ends—a couple of knitting needles, an old tap washer and a Rolls Royce Merlin valve spring which happened to drop outside from a passing air-liner. After assembling this on top of the



Boiler No. 1

new boiler, I once more stood it on the gas-stove, having taken the precaution of sending my Aunt to Hove for the day. This time there was no explosion, in fact nothing happened at all for quite a while, and then the whole thing suddenly fell to pieces. I had forgotten the water. However, the sixth boiler was completed without mishap, and as I did not think it advisable to do any more testing at the moment, it was laid aside until required.

Having read somewhere in THE MODEL ENGINEER that bronze is the stuff for pistons, I decided to spare no expense and use two threepenny bits for each piston. A pair of cylinders

Boiler No. 2

were turned up, but it was found that considerable leakage took place round the edges of the threepenny bits, so these cylinders were thrown into the scrap-box and work was started on a new pair with polygonal bores. At first sight it might seem something of a problem to produce these by normal machining methods. This is by no means difficult, however, it is merely a matter of adjusting the chatter-rate to twelve chats per revolution and taking deep cuts. This was done, the cylinders were bored out and the pistons carefully hammered in. The port cylinder was $1\frac{3}{4}$-in. stroke while the starboard

Boiler No. 3

one was only $1\frac{1}{4}$ in. owing to a shortage of bar, and as both pistons were to drive the same crank-pin another snag was encountered, which the more astute reader will at once perceive. This was ingeniously got over by opening out the crankshaft bearings to a rather sloppy fit and using spring connecting-rods.

As all readers of THE MODEL ENGINEER will have noticed, valve gear is a constant source of controversy of the most violent and rude character. Some say slide valves are best, others hotly maintain that piston valves are the only possible kind. Some experts are in favour of Walschaerts or Stephenson's gear, while others say that strength through Joy should be the motto. It is obvious that there must be something basically unsound about a mechanism over which there is so much disagreement, so in this case it was decided to dispense with valves altogether. Some people believe that a horizontally opposed engine works best if one cylinder pushes at a time and that this can only be done with valves, but a few moments thought will show the fallacy of this argument. Who could imagine a rowing eight winning a race if half the crew pulled while the other half pushed? I believe in conveying

Boiler No. 4

steam to both cylinders at once and letting them sort it out for themselves. Of course, with this system, the crankshaft does not actually revolve, but this is all to the good, as it prevents wear in the bearings. It is a fascinating experience to see the two cylinders straining at the crankpin, locked in mortal combat as it were, while the boiler dances impotently up and down in the background. Indeed, I believe this to be one of the first successful working models ever made of an engine with stationary cylinders and an oscillating boiler.

Having got this far, I felt the urge to see something concrete resulting from my labours, so a start was made on assembling the engine. First I sent my Aunt to Wales for three weeks, and then I obtained a massive piece of iron plate for the base. This proved to have a number of

Boiler No. 5

high spots, and after many hours of patient scraping and filing these were transferred to entirely new positions. I then met with another set-back, for though I hunted high and low I could find no trace of the boiler. I can only assume that it had accidentally rolled into the scrap-box and got irretrievably buried. The only thing to do was to make another, and as there was now a shortage of treacle as well as of brass, a baked bean tin was pressed into service. The beans were taken out and thrown into the scrap-box, and a very tedious job it was, too, getting them out through a little hole in the top, but it did save soldering the lid on afterwards. The boiler was finished without any trouble and was well bolted down together with

the cylinder assembly. Now I do not claim to have an extensive knowledge of advanced steam engine theory, but it seemed to me that it would be a good idea to have a sort of pipe between the boiler and the cylinders, so a strip of copper was obtained, carefully bent round a long narrow hole and the joint soldered up.

It was at this point that an engineering friend of mine happened to drop in for breakfast, and I showed him the engine. He looked at it for some time and then shook his head sadly.

Boiler No. 6

"Well, have you any suggestions ?" I asked, heaving open the lid of the scrap-box in readiness.

"It's all right as far as it's gone," said my friend, "but there is just one thing that completely ruins it. No weeny injector !"

Now everybody ought to know by now that when it comes to weeny injectors, there is only one expert worthy of the name and that is our old friend Lancelot Bilkington Sowerby-Chambers, whose well-known modesty permits him to sign his weekly outbursts with his initials only. Accordingly, back numbers of THE MODEL ENGINEER were removed from under the short leg of the piano and an article was found describing the making of these mysterious weeny injectors. The first three pages were devoted by "L.B.S.C." to an interesting account of his domestic arrangements, including a graphic description of the antics of his No. 3 Ideal boiler and a few rude remarks about the price of coke. Then he got down to business.

"Part off a dozen $\frac{7}{8}$ in. lengths of $\frac{5}{16}$-in. brass rod for the bodies," he said. "Turn and screw ends."

A dozen seemed rather a lot, but I did exactly as directed. Then followed a lot of complicated rigmarole about chucking and reaming, which I carried out to the letter, and then I came to the words ". . . and drill 12 No. 72 holes."

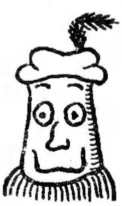
I have often wondered how the system of numbering drills was arrived at. Now I know. Apparently, after many exhaustive tests, it was found that the average number of drills broken in drilling a hole of a certain size was thirty, so this was called a No. 30 hole. Smaller holes require smaller drills to make them and these break more easily, so the smaller the hole the higher the number of drills required to drill each one. Holes smaller than No. 80 are financially impracticable.

To get back to the weeny injector, I had not got any No. 72 drills, so I used the nearest size available which was $\frac{3}{16}$ in. As the outside diameter of the cones to be drilled was considerably less than this, I had to throw the whole lot in the scrap-box and make another set much bigger. I carried on stage by stage until I reached the end of the instructions, and then I found to my amazement that I had not one, but *twelve* weeny injectors, each one 9 in. long and weighing about 4 lb. On re-reading the beginning of the article I found the explanation of this extraordinary occurrence. It seems that "L.B.S.C." has twelve personal friends, and each Christmas he solves the gift problem in an economical manner by sending them a weeny injector each, which they immediately convert into ball-point pens. The article was merely a little treatise on mass-production. It seemed a pity not to use them after all that palaver, so they were equally disposed around the boiler, and very impressive they looked. Unfortunately, not one of them showed any signs of working ; in fact I never even found out what they should have done if they had worked, and as the weight of them was causing the sides of the boiler to cave in slightly I removed them all and threw them into the scrap-box.

The Test

There now seemed to be nothing further to be done except to test the model under steam. I must confess that I had certain misgivings about this, and kept putting it off from day to day. It was not that I had any doubts about the quality of my workmanship or even about the soundness of the design, quite the reverse. It was just that the machine looked so utterly unlike anything I had ever seen before, a true prototype, in fact.

One Saturday morning my Aunt went off to the South of France for an indefinite stay, so I plucked up courage and took the model into the garden. I decided to use methylated spirit in the boiler, as this vaporises more readily than water. The furnace was filled with equal parts of petrol and nitric acid, a mixture which I find burns extremely well. A forced draught system was improvised by connecting a powerful vacuum cleaner to the chimney. I applied a match, switched on the vacuum cleaner and retired to the kitchen to make a cup of tea while the pressure mounted. The kettle had barely boiled when there was a deafening crash which, however, seemed to come not from the garden but from my workshop. Greatly puzzled, I threw open the kitchen door and was met by a dense cloud of dust, and when I reached the workshop I found that disaster had once again overtaken me. It seemed that the gradually increasing weight of the scrap-box had at last been too much for the floor, and the whole lot had crashed into the basement. As I stood staring in horror at the gaping hole, there came a sharp report from outside, followed by a sort of "Wheeeeeee . . ."



My Aunt

Fortunately, things turned out rather better than seemed possible at the time, as the rubble from my workshop was usefully employed in filling up the crater in the garden. I still turn up strange pieces of brass and steel when digging trenches for my early carrots. No trace of the model or vacuum cleaner has been seen again ; it had not occurred to me to follow the example of our model aeroplane brethren and affix a small label with my name and address.

I have finished with steam, it is too arbitrary and dangerous. At the moment I am conducting some experiments in nuclear fission and the application of atomic power to bicycle propulsion, and I shall be happy to describe the results in the near future. (But not in this magazine.—Editor.)

THE LOST CHORD

A Railway Ghost Story

BY L. B. S. C.

THE whole business started on the day *Queen Mabel*, after nearly hitting an aeroplane that crashed on the line, broke the speed record. It so happened that one of the girl passengers on the R.C.A. excursion, was the daughter of the editor of a leading London evening newspaper. She was a born journalist, ever on the lookout for scoops, and she always carried a small but powerful camera in her handbag. Her friends jocularly called her "The Spy." She got some excellent shots of the near-disaster; and as soon as the train stopped at Bournemouth, she put her roll of film on the next train to Waterloo, telephoned her dad to have it collected and developed, and told him the whole story over the wire. The result was, that the 6 p.m. edition of the *Evening Flag* carried a banner headline—"LADY ENGINE-DRIVER AVERTS DISASTER—BREAKS SPEED RECORD"—and gave the full story, plus a log of the run taken by "The Spy's" special friend Cecilia Allen. The reception given to Driver Joy and Fireman Alice when *Queen Mabel* pulled up three yards from the buffer stops, three minutes early, on the return trip, beggars description! Suffice it to say that after posing for photographs, with guards Gert and Daisy, beside the engine, they were glad to hand it over to a Nine Elms driver and fireman to take to the sheds, and get home to Ashford for a well-earned sleep.

It wasn't likely that the other companies were going to let the Southern literally pull a fast one on them and get away with it. Something had to be done about it, so the various C.M.E.s called meetings of works managers, depot supers, running-shed foremen, and top-link drivers; and soon the drawing offices at Swindon, Crewe, Doncaster, etc., were buzzing like bee-hives on new designs. Meanwhile, the Southern C.M.E., Sir Roy Donalot, had been unanimously elected President of the Institution of Locomotive Engineers for the 1984-5 session, and had chosen as his presidential address, an account of "Locomotive Development on the Southern Railway." He described his conception of the twin piston-valve arrangement, having separate admission and exhaust valves, and how he tried it out by building a $\frac{1}{16}$ in. ($3\frac{1}{2}$-in. gauge) experimental 4-6-2 three-cylinder locomotive in his own private workshop ("*What* a busman's holiday" cheerily interjected a member, provoking loud laughter in which Sir Roy heartily joined) testing the engine on his garden railway, making adjustments as needed, and adding accessories such as the accelerator attachment to the valves, which he had since patented. This gave a full port opening as the crank passed the dead centre, giving a hitherto unheard-of amount of lead without any pre-admission trouble. The variable exhaust was another innovation. He then described the building of *Lady Vera*, the first of the series in full size; the Sunday morning trial run, with a trainload of Ashford employees, on which the engine had exceeded the L.N.E.R. *Mallard's* record speed; and the inaugural run of the *Golden Arrow* on the one-hour schedule, when *Lady Vera* attained 150 m.p.h. at Paddock Wood.

Sir Roy then recounted how he developed the design into a four-cylinder 4-6-4 for the heavier trains on the Western section (the *Queen* class) and added further improvements, such as the automatic water scoop, cab signalling, and so on; and he continued:—"These engines have proved themselves able to run consistently at 150 m.p.h. with the heaviest loads they have so far been called upon to tackle; the accelerated services in current timetables are maintained with ease, but there is a curious circumstance which neither my colleagues nor myself have so far been able to explain. *Queen Mabel*, when running the R.C.A. works outing with an 18-Pullman load, attained a speed of 180 m.p.h. on the Southampton avoiding loop. There is no question of the speed; the log of the run, published by the *Evening Flag*, was absolutely correct, and as the engine has a recording speedometer, I have brought the roll, part of which you see on the screen (it was showing). You will observe that the speed was sustained for six miles, until the regulator was shut for the west junction. However, the curious part is this. Neither *Queen Mabel*, nor any other engine of the class, has attained that speed since! My test crew, Driver Barlow and Fireman Clancey, have run the *Bournemouth Belle* and other crack trains with them; and going all out, the best they have done is 166 m.p.h. with *Queen Mabel* herself, over the same bit of line. My daughter, who was driving the engine when she broke the speed record, cannot remember exactly how she had set the admission and exhaust valves, which are controlled by small concentric hand-wheels, with circular notched plates held by small latches. She jocularly refers to the missing combination as the "Lost Chord," and the phrase has caught on; the friendly crack "Has anybody found the Lost Chord yet?" is frequently heard in the enginemen's lobbies."

The Challenge

Sir Roy sat down amid loud applause, and Mr. B. W. Hockington, who had succeeded "Windmill Bob" as C.M.E. of the Great Western rose to reply. He thanked Sir Roy for a very lucid and informative address, and for his kindness in placing such valuable information at the dis-

posal of members. He said that he, too, had tried the twin piston-valve arrangement, but unlike Sir Roy's, both valves operated admission and exhaust together, giving the effect of one very large valve, which admitted and exhausted steam to the cylinder at a very rapid rate. He had also tried experiments with clearance volumes, and had designed a 4-6-4 type (the *Rose* class) incorporating these and other improvements. Two of the engines, *Rose of Tralee* and *Rose of Killarney*, were running the Irish boat trains between Paddinton and Fishguard; and with these trains, frequently loaded up to 600 tons, speeds between Swindon and Paddington often exceeded 150 m.p.h. He added "Like Sir Roy and his talented daughter, I'm a passed driver myself, though I don't hold a union card (laughter) and believing also in first-hand experience, I frequently take the regulator in service, as did that famous old Victorian locomotive engineer, William Stroudley. Actual personal experience has enabled me to make further improvements on a batch of ten, now in hand at Swindon; and I'd love to challenge Sir Roy to a friendly race. As the travelling public well know, our tracks are now perfectly safe for any speed that our engines can attain; and a real race under present conditions, would create far more interest and excitement than those between the East and West Coast routes, which took place a century ago. The snag is, a suitable course; it would be unfair to stipulate London-Plymouth, as the Southern road is much harder than ours, and it needs at least 120 miles to give both engines a chance."

Several other members expressed appreciation of Sir Roy's address, and commented on the idea of a race; and then Dave Owen, the up-and-coming C.M.E. of the London & North Western Railway, rose to speak. He was the youngest full member present, and had risen to top rank through sheer ability. Promotion at this time was by *merit*, not by seniority; the only time the latter ever counted was when two persons of equal merit were considered for a position. However, once attained, *a position had to be held*; no "resting on laurels" in a world of progress, or the "slacker" was soon superseded! After complimenting Sir Roy on his address, and commenting on various points of design in both *Queen* and *Rose* classes, he continued "I see no reason why the race cannot be run. We are now putting in a burrowing junction at the north end of Rugby station, and altering the layout, so that non-stop trains need not slack below 90 m.p.h. The work should be completed in the early spring, and then that will be the only speed restriction between Euston and Birmingham. I understand that the G.W.R. line is also free from restrictions between Paddington and Birmingham, and I suggest the race be run between those places. Our directors would be only too glad to oblige our Southern friends, apart from the advertising and publicity value. Well, gentlemen, what about it?"

This suggestion was received with great enthusiasm; Sir Roy and Mr. Hockington both expressed approval, and it was arranged for the race to take place in the following spring, starting from Birmingham and finishing in London, which would be more convenient for the public, press, newsreels and television. The "combatants" shook hands heartily, wished each other luck, and departed to their respective home towns, to spread the glad tidings among the staff, and put them on their mettle.

Getting Ready

The winter passed away, and in the early spring, when the new layout at Rugby was completed, a date was fixed for the race, at the end of April. Sir Roy decided to run *Queen Mabel*, as she had already broken the speed record. Mr. Hockington chose one of his latest batch, *Rose of Eythorne*, which had topped 160 m.p.h. several times on the *Cornishman*. Both C.M.E.'s decided that they couldn't do better than let their test crews run the trains, so Johnny Barlow and Pat Clancey (who had just passed his examination for driver) were assigned to *Queen Mabel*, and Rob Dennis and Brian Kenway to *Rose of Eythorne*. As the latter were running over their own road, all they needed were a few trial runs on the Birmingham expresses, to make sure the engine was in tip-top fettle; but the Southerners had to learn the road, so *Queen Mabel* was given a temporary new home at Camden running-sheds, and took turns on the Euston-Birmingham 90-min. trains, with a L. & N.W.R. driver as pilotman. A very few "piloted" trips sufficed for Johnny and Pat, as the track contacts for the Nor-West's automatic cab signals were the same as those on the Southern (though the cab indicators were different) and *Queen Mabel's* cab indicator operated as well as when running on her own road. As Sir Roy naturally wished for data on how his engine behaved on a "foreign service," Inspector Mills and Joy took turns at riding on the engine, and noting the required details. Incidentally, Joy knew every inch of the Euston-Birmingham road, as well as she knew the Southern, for the L.N.W.R. directors had presented her with a permanent engine pass, in appreciation of her skill as a driver, and her coolness and resource in time of emergency. As her "mum," Lady Vera, was a native of Lady Godiva's home town, and all her maternal relations lived either in Coventry or Birmingham, she was constantly travelling up and down the line.

To ensure a fair start, radio-controlled alarm bells, like those used for automatic fire alarms, were installed at Snow Hill and New Street, arranged first to give a warning, and one minute

later, the "right away." Arrangements were made for television and newsreel cameras at all four terminal stations, and at various places along the line, and also for illuminated diagrams of the progress of the trains at the principal stations. Each train was to be composed of twelve 70 ft. roller-bearing Pullmans with radio-telephone equipment; no tickets were sold, the passengers consisting exclusively of directors, officials, guests, press and broadcasting personnel. Public enthusiasm rose high, the race being regarded as a sort of railway version of the Derby or St. Leger, and the bookmakers did a roaring trade; whilst partisanship exceeded that of a Cup Final, especially among the youngsters!

Fate Takes a Hand!

The afternoon of the great day was fine and sunny, and crowds assembled at both ends of the lines, and at various points of vantage along the routes. Loud cheers greeted the "foreigner," *Queen Mabel*, as she backed on to the L.N.W.R. train at New Street, 15 mins. before departure time (4.30 p.m.). Johnny Barlow made his brake test, and Pat took a final look at the stoker-engine mechanism, and tested the live-steam injector. Sir Roy, Dave Owen, some other officials, Lady Vera, Joy and her daughters, Alice and her husband (Chief Civil Engineer) and the stationmaster, all went up to the engine, to form a requested group photograph, with Johnny and Pat, when disaster struck like a bolt from the blue. Johnny had taken his oil feeder, and had a final look-around, according to engine-driving tradition; and as he came around the front of the smokebox, he somehow slipped, and crashed down on to the ballast with one leg twisted underneath him. He tried to rise, but sank back with a moan of pain. Sir Roy and Dave Owen jumped down and rendered what assistance they could, whilst the stationmaster called the ambulance team; a hasty examination proved that no bones were broken, but poor Johnny's left ankle was badly dislocated, and he was rushed off to hospital at once.

"Thank Heaven it wasn't any worse," said Sir Roy, "Johnny says he's more upset about being out of the race, than dislocating his ankle; but what are we going to do now?"

"Drive *Queen Mabel* yourself, Roy," suggested Lady Vera. "I would," he replied, "but I don't know the road. What about you, Pat?"

"If Clancey can run the engine, I can find him a fireman," said Dave Owen, "but it will take 15 or 20 mins. to get one here, and it looks as though we'll have to call off the race, and disappoint the public."

There was silence for a few seconds, and then the excited voice of Rosa, Joy's elder daughter, burst in. "Oh, no we won't!" she cried. "What's to prevent mum and Auntie Alice running it?" She turned to Joy. "You wouldn't let grand-dad and the old Southern down, surely mum?"

Joy looked inquiringly at Alice, who nodded. "O.K. dad," said Joy, "we'll do it—it'll about finish off our dresses, though it'll be worth it."

"Losh, there's nae need tae ruin yere pretty frocks—juist bide a wee!" chimed in the carriage-cleaners' forewoman, who was standing by; and she dashed off, to return almost immediately with two new overall coats, mob caps, and cotton gauntlets, as worn by the carriage "chars." Lady Vera had already taken charge of Joy's and Alice's coats and hats, and the forewoman helped them into the overalls.

There was a buzz of excitement among the crowd as the news spread, and was telephoned to Snow Hill, and away down the line.

"Take your seats on the racing special—three minutes to go," came the announcer's voice from the loudspeakers.

"Going to ride with us, dad?" asked Joy.

"No," said Sir Roy, "you'll be better on your own"; and he and Pat went back to the train, while Joy and Alice climbed into *Queen Mabel's* cab. Everything was ready. Alice started the stoker engine as the alarm bell sounded the warning; the crowd stood back from the train, and as the bell clanged "right-away!" the guard waved his flag and hopped aboard. Joy swung around, her high-heeled shoe kicking open the air-sander valve, and she pulled the regulator halfway open, as Alice tugged the whistle cord.

The Race

With a joyous "Whoo," a deep sigh, and a quiver, *Queen Mabel* "dug her heels in," and brought the whole of her 66,000 lb. of tractive effort to bear on the drawbar; and the terrific roar from her little shapely chimney sounded like a hearty laugh, as she whisked the twelve Pullmans away to such good purpose that the last one left the platform at 30 miles per hour! Down the 1 in 77 into the tunnel she dived, like a car on a giant racer at a fairground, taking the short rise at the end in her stride; then, as Joy notched up and adjusted the exhaust release, she gathered up her skirt and went for it, passing Adderley Park at 90 m.p.h. and Stechford at 121. Down the long easy grade she flew, doing her $2\frac{1}{2}$ miles per minute past Marston Green; never checking up the rise to Beechwood Tunnel, she topped the summit, accelerated still further, and tore past the cheering crowd on Coventry Station at 165.

Back in the train, Dave Owen looked at the flying scenery, and said to Sir Roy "Your daughter is certainly some driver!"

"She loves it," said Sir Roy; and then added "I could name somebody else who would have loved this run."

"So could I," replied Dave. "Still read the 'M.E.'?" "You bet," said Sir Roy, taking from his pocket the current issue, dated the last week in April, 1985. He handed it to Dave,

who idly turned the pages, and commented "I see the articles on 'Two Very Old Maids' are still running," at which they both smiled.

The cab signal flashed a yellow warning, then three green flashes, as she passed Brandon, indicating that the road was set for the through line at Rugby, on to the direct route through Kilsby Tunnel. Joy shut off for the 90 m.p.h. speed restriction, and as they approached Rugby, she saw a train converging towards them on the Trent Valley line. Remembering a similar meeting at Shortlands, when she was driving the *Golden Arrow*, she instinctively reached for the whistle-cord and sounded the "ghost" call.

The other train was the Manchester-Euston *Teatimer*, which called at Rugby, hauled by one of Dave Owen's 4-6-4's, *Luck of Edenhall*, in charge of Bill Procter and Bert 'Obbs. When Bert heard the "Whoooo-whooooo-whoo-whoo!" he nearly jumped out of his pants; and looking over the side, he exclaimed: "Blimey, Bill, 'ere's that Souvern ghost agin—wot the 'ell's going' to 'appen nah?"

"Why, you chump, it's only the race train," replied Bill, "have you forgotten?"

Bert heaved a sigh of relief, and looked out of the side window as the two engines came abreast on the parallel tracks; then exclaiming, "Gorlummy—skirts!" he grabbed the whistle-cord, blew a wolf whistle, and frantically waved his cap as *Luck of Edenhall* dived into the burrowing junction to reach the platform.

Joy and Alice looked at each other and grinned; then Joy opened up again as *Queen Mabel* cleared the junction, and the engine rapidly accelerated to 130 up the long rise to Kilsby tunnel. As she dashed out of the south portal, the excited voice of Rosa came through the telephone speaker. "Step on it, mum—keep her hot, auntie—Rob's just passed Fenny Compton and the *Rose* is doing 120 up the bank—they're level with us!" Joy paused as she was notching up for the down grade to Blisworth, and muttered: "If only I could find the 'Lost Chord——'" when a voice said: "Try one more notch back on admission, and seven forward on the exhaust; that ought to do it!"

"Eh?" said Joy, looking across at Alice, who opened her eyes wide and replied: "I didn't speak; I thought you said something about trying seven on the exhaust."

For an instant Joy looked puzzled, then her eyes went starry and she laughed almost hysterically. "I've got it—we're going to win!" she said, and made the adjustment. As the latch clicked into the notch, the effect was as if *Queen Mabel* were a spirited horse lightly touched by whip or spur. She seemed to leap forward, and the speedometer went up and up until the needle was just over the 180 mark! Down the grade she swept, around Weedon curve, and through Stowe Hill Tunnel like a bullet through a gun-barrel; she whizzed through Blisworth, taking the rise to Roade in her stride, on through Wolverton, Bletchley and Leighton Buzzard (putting the "buzz" into the latter with a vengeance!) only dropping to 162 up the rise to Tring; over the summit, then down in a final mad fling through Watford, Harrow and Willesden. As they approached Kilburn, Joy shut off and braked; and as the train left Primrose Hill Tunnel, Rosa's voice came through once more—"Hooray, mum, you've won! Rob's just passed Old Oak." Joy braked to 30 m.p.h. down Camden bank, and finally stopped *Queen Mabel* four yards from the buffers, to get a reception that had never been accorded to any engine-driver before!

A driver and fireman had been summoned from Nine Elms to take the engine home, and as the two women handed her over and stepped off the footplate, they were absolutely mobbed by the cheering crowd, while the passengers crowded around with congratulations.

"The Spy" got a lovely close-up of Sir Roy kissing his daughter, and Cecilia Allen handed him her log of the run, which was as follows:—

Birmingham (New Street)-Euston. Racing Special.
Engine—1984 *Queen Mabel* (Southern Ry. 4-6-4, four-cyl.).
Driver—Joy Donalot. Fireman—Alice Meylen (Ashford).
Load—12 Pullmans (510 tons gross).

Miles	Stations		Time h.	m.	sec.	Speed*
	Birmingham		h.	m.	sec.	
—	New Street	dep. ...	4	30		—
1¾	Adderley Park	pass ...	4	32	15	90
3¾	Stechford	,, ...	4	33	30	121
6½	Marston Green	,, ...	4	35		148
10	Hampton-in-Arden	,, ...	4	36	20	156
13¼	Berkswell	,, ...	4	37	35	156
15¼	Tile Hill	,, ...	4	38	30	161
18¾	Coventry	,, ...	4	39	50	165
23¾	Brandon	,, ...	4	42		160
30¼	Rugby	,, ...	4	45	15	†90
37½	Welton	,, ...	4	49		143
43	Weedon	,, ...	4	51		180
50	Blisworth	,, ...	4	53	20	181
53	Roade	,, ...	4	54	30	174
58	Castlethorpe	,, ...	4	56	10	180
60¼	Wolverton	,, ...	4	57		181
66	Bletchley	,, ...	4	59		178
72½	Leighton Buzzard	,, ...	5	1	15	176
76¾	Cheddington	,, ...	5	2	45	174
81	Tring	,, ...	5	4	25	162
84¾	Berkhamsted	,, ...	5	5	45	178
88¼	Boxmoor	,, ...	5	6	55	180
91¾	Kings Langley	,, ...	5	8		181
95¼	Watford	,, ...	5	9	10	181
96¾	Bushey	,, ...	5	9	40	176
99½	Pinner	,, ...	5	10	35	180
101¼	Harrow & Wealdstone	,, ...	5	11	10	181
104¾	Wembley	,, ...	5	12	20	181
107¼	Willesden	,, ...	5	13	10	179
109	Queens Park	,, ...	5	13	50	160
109¾	Kilburn	,, ...	5	14	15	120
110¾	South Hampstead	,, ...	5	15	10	85
112¾	Euston	arr. ...	5	20		—

* By speedometer in 3rd car. †Service slack.

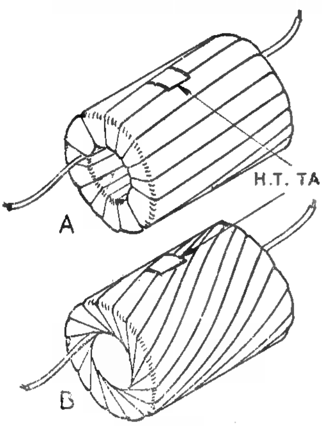
Joy and Alice were glad to escape to the ladies' room for a clean-up and a rest, after which they proceeded to the Cannon Street Hotel for the celebration dinner at 8 p.m. Between the toasts and speeches, a telegram of sympathy, with good wishes for a speedy recovery, was sent to Johnny Barlow in the Birmingham hospital.

(*Continued on page* 828)

A Magneto for the "Busy Bee"

by Edgar T. Westbury

AFTER the coil has been properly impregnated, and dried off at the temperature recommended for the particular varnish used, it should be given a spark test before final assembly in the magneto. A simple but efficient "hook-up" for coil testing is described in the handbook *Ignition Equipment*, in which a 4-volt accumulator is used as a source of current, and a coarse



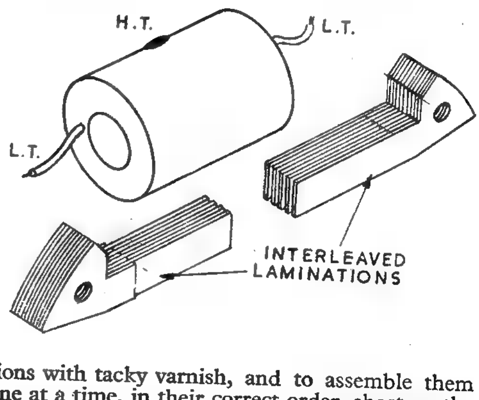
file is used to serve the purpose of a contact-breaker. The "live" side of the primary winding is attached to one terminal of the battery, and the "earth" side to the file. A probe, or a large nail, is connected to the second battery terminal, and the condenser which is to be used in the magneto is connected between this and the file. By rubbing the probe along the file, contact is rapidly made and broken, and under these conditions, it should be possible to obtain a $\frac{3}{16}$-in. spark between the h.t. tab of the coil and a conductor "earthed" to the file. Do not be tempted to use a larger gap at this stage, just to see how big a spark can be obtained; and above all, do not attempt to apply the spark test *before* the coil is impregnated, or it will probably give one or two half-hearted sparks and then break down internally. In the case of a separately-wound coil, it will be necessary either to fit the interleaved core in place, or to pack it with a bundle of laminations or iron wires, in order to make the test.

Although the coil, when impregnated, should be practically solid and waterproof, some further covering, hermetically sealed against the entry of moisture, is necessary both for mechanical protection and extra insulation. From experience, I have found that the use of a bakelite tube, with end pieces cemented in, is very difficulty to improve upon, but a more common practice nowadays is to tape the coil, which is perfectly satisfactory if all joints are properly sealed with varnish afterwards. This treatment can be applied either to pre-wound or wound-on-core coils equally well.

The tape most commonly used for ordinary electrical work, such as armature or field coils of motors and generators, is usually already varnished, but this, in my experience, is not so suitable for the present purpose as "raw" (untreated) cotton or linen tape with "deckle edges," i.e. cut diagonally and without a selvedge, about $\frac{1}{4}$ in. to $\frac{3}{8}$ in. wide.

The usual method of taping a coil, shown at *A* in the drawing, is obviously inapplicable to coils wound directly on the core, but the method shown at *B* can be used for either this or separately wound coils. It will be seen that the tape passes diagonally, or more correctly spirally, around the coil, cuts across the chord at the ends, and returns in a spiral of the reverse hand on the other side. For either kind of taping, the tape must obviously be narrow and have "edge flexibility" to lay evenly, without puckers. The l.t. wires (which should be sleeved) and the h.t. strip, are brought out through the taping as shown. Finally, the coil is sealed by dipping in varnish and drying out under moderate heat, several times if necessary, till an impervious coating is obtained.

The method of assembling a separately-wound coil on a divided core is also shown, and requires little explanation. It is desirable to coat the lamina-



tions with tacky varnish, and to assemble them one at a time, in their correct order, short on the right and long on the left, then long on the right and short on the left, and so on. The fixing holes are lined up by pushing a taper rod through them, prior to assembling the complete stator on the backplate. Any slackness between the coil and stator, when in position, should be taken up by thin slips or wedges of fibre or bakelite, fitted as tightly as possible, and cemented in place, on each side of the core. Soldered tags, and P.V.C. or Systoflex sleeving, should be fitted to the connecting leads.

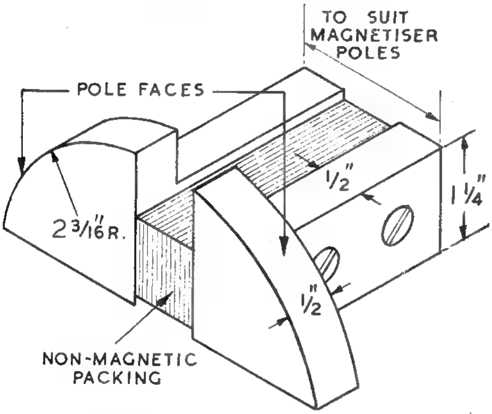
Connecting up the magneto is very simple, the

Continued from page 815, "*M.E.*," *December* 18, 1952.

inner end of the primary being earthed to the nearest screw, as in the case of the l.t. coil, while the combined OP-IS lead is taken to the contact-breaker spring, and also to the "live" side of the condenser. The latter, it should be mentioned, is the smallest automobile standard type, as made by all leading manufacturers, such as Lucas, Delco-Remy, Remax, etc., and it is secured to the backplate by a clip with a single screw, on the opposite side to the contact-breaker; a good electrical contact is essential.

Timing the Contact-Breaker

The magneto is assembled on the engine or test rig, less the flywheel, and the hub placed on the shaft; then the hub is turned in the direction of rotation, to the position where the points are just about to break; that is, when the resistance of the rocker spring begins to be felt. Next, the flywheel is placed on the spigot of the hub, and located so that the h.t. stator poles just



bridge the gaps of the rotor poles. Without moving the hub, the flywheel is turned, still in the same direction as the engine rotation, for a further 15 deg.; this is the position where it should be permanently fixed to the hub. It is, however, advisable first to *clamp* the flywheel to the hub, which can easily be done by using the extractor, with a thick washer under the head, to bear on the flywheel face. This will enable a test to be made before final fixing, the reason for this being that the exact optimum position of the break, relative to the magnet poles, varies slightly according to the magnetic properties of the iron in the pole pieces, and also the flux density of the circuit. When this point is finally settled, the flywheel may be fixed with rivets, or alternatively, with set screws having shakeproof washers under the head.

It should be noted that this process locates the position of the rotor and stator poles, relative to the breaking of the contact points, in order to obtain the maximum spark efficiency, and has nothing to do with *timing the spark*, relative to the position of the engine piston or crank. This is carried out in the usual way, by shifting the entire hub and flywheel assembly on the shaft, so that the break occurs at the specified time, that is, 20 to 25 deg. before top dead centre for the "Busy Bee" engine. The above instructions hold good for either direction of engine rotation.

Magnetising

As previously mentioned, this should preferably be done *after* the assembly is complete. Few people will have access to a suitable four-pole magnetiser, but most ignition repair shops have one of the two-pole type, adapted to take an ordinary magneto between its pole pieces, which are adjustable for width, and this can be adapted to magnetise a four-pole magnet by the use of a simple jig as shown. This can be made of mild steel or wrought iron, with solid or built-up limbs, and a non-magnetic packing piece of wood, fibre, brass or aluminium sandwiched between.

The poles should be arbitrarily marked 1,2,3,4, (pencil or chalk will suffice), and with the jig between the magnetiser poles, the curved shoes overhanging to one side, the flywheel is placed on it with poles 1 and 2 uppermost, and the current switched on for a brief "flash." It is then turned 180 deg., to bring poles 3 and 4 uppermost, and the process repeated. Then the jig is reversed in the magnetiser, so that the pole shoes overhang at the other side, and similar treatment applied to 2 and 3, then 4 and 1. This will ensure that all four of the magnets are equally saturated.

In commercial practice, a four-pole magnetiser, capable of dealing with the set of rotor poles simultaneously, would no doubt be employed. But in any case, it is most important that the magnetiser should be efficient, as the superior qualities of modern magnet steels cannot be obtained unless they are saturated to their maximum flux density.

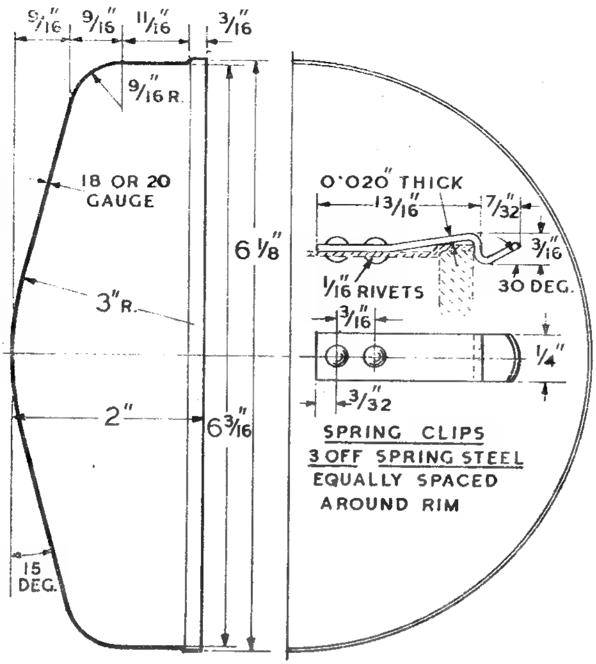
Magneto Cover

This is not shown or indicated in the general arrangement drawings, but it is an obviously desirable, if not essential fitting, not only to protect the magneto from rain and dirt, but also to prevent the rider's clothing from getting caught up in the works. A cover is a standard fitting on the commercial magnetos used on cycle engines, but while the cover itself is quite sound, the method of fixing often leaves much to be desired. I have seen many of these engines on the road *minus* magneto covers; the latter, no doubt, are now serving in roadside cottages as extemporised crocus bowls, or as morions for juvenile Elizabethan pikemen!

The cover shown can be made by the methods best suited to the skill and facilities of the individual constructor, such as spinning, beating, or fabrication. I favour the former method, because it is the easiest, and usually produces the most accurate and neatest result, if one learns to master the technique. The shape can be formed on a hardwood former, by the methods which were described for the "Busy Bee" tank ends, though as the "draw" is much deeper, it will be rather more difficult, and call for several more annealings. Although 20 gauge material gives ample strength, most workers will probably find the thicker material easier to work where deep drawing is required.

The spring clips can be made from the "half

hard" spring steel as described for the contact-breaker, which will bend to the shape shown without annealing if care is taken. Only a very slight "set" should be given to the long portion of the spring, so that it bears on the rim when riveted, and will snap firmly into place over the magneto back-plate. If more positive security is required, it is possible to fit a bolt and nut in place of the second rivet, shifting its position as close as possible to the rim; the nut is tightened when the cover is in place, and holds the clip more firmly than is possible with its natural spring.



MAGNETO COVER 1 OFF ALUM.NM. OR COPPER

A magneto constructed in accordance with this design and these instructions will give efficient and trouble-free service both for ignition and lighting, over a very long period, on any small engine. If the coils are properly protected as specified, there is practically nothing to go wrong, and I have made long tests with the experimental types, with quite satisfactory results. Some readers may object to the size of the magneto, which is larger than some commercial types, but this is a deliberate policy, with the intention of promoting reliability and simple construction. It *could* have been made considerably smaller, but constructors with no special experience of coil winding would find it very difficult to wind efficient and reliable coils in the smaller size. As with the "Atomag Minor" and other magnetos I have described, I have allowed ample margins to cover various imperfections and spots of bother which may crop up; and the many readers who have constructed these magnetos successfully will bear me out as to the soundness of this policy.

I have been asked for advice on running the "Busy Bee" on battery and coil ignition, or alternatively, on fitting a low-tension magneto to supply current to an ignition coil. While I have always believed and maintained that there is nothing to beat a good high-tension magneto, there is no doubt that battery ignition is perfectly satisfactory and reliable if properly carried out. Be sure to use a *really* good coil, and a battery of ample current capacity—not a 1 oz. coil with a Penlite dry cell! The contact-breaker can be of the type described for this magneto, and operated by a cam on the flywheel hub in the same way. It is also possible to convert this magneto to a low-tension type by using *two* low-tension stators and coils, and connecting them in parallel to double the current output. As low-tension machines are often poor in performance at low r.p.m., starting voltage might be boosted by temporarily switching the coils into series, so long as the lighting circuit is disconnected at the time.

Our Business is Humming!

At this season, it is appropriate to acknowledge and reciprocate the greetings of many "Busy Bee-keepers," some of whom seem to have exhausted the apiarist's glossary in eulogising the engines they have built. It has been described as "a real worker," and "no drone," but the prize goes to a Transatlantic constructor, who remarks in his native picturesque idiom, "Boy, the Busy Bee sure is a HONEY!"

The Lost Chord

(*Continued from page* 825)

Then Mr. Hockington made a few witty remarks, commending Joy and Alice for readily stepping into the breach—"I'd better not say breeches," he added, amid loud laughter—and for their skill in beating his engine by a short head. Joy made a suitable response, but a note of sadness in her voice was manifest to all; and as the diners left the hall, Sir Roy took his daughter's arm and drew her aside. "Did you—was it——" he began.

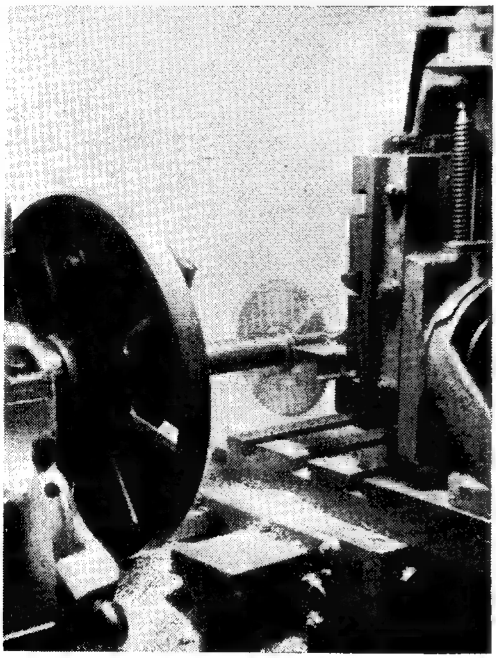
"Yes," said Joy. "Just south of Kilsby Tunnel—the 'Lost Chord'—the voice of Curly."

The Allchin "M.E." Traction Engine

to $1\frac{1}{2}$-in. Scale

by W. J. Hughes

IN the full-sized engine, the bearing-brasses for the crankshaft and second shaft [redacted] split, and [redacted] held in the brackets, which [redacted] riveted to the hornplates, by means of keeps. The latter incorporate the syphon oil-boxes, and [redacted] held down by studs tapped into the brackets. Adjustment of the crankshaft brasses is by [redacted] of [redacted] set-screw, with a lock-nut, fitted to the front of the bracket, but the second shaft bearings are not so fitted.



Photograph No. 18. Sawing off the bearings square and true to length

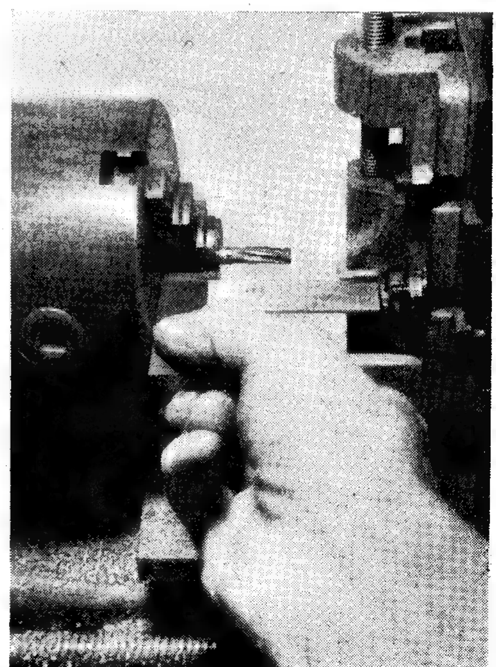
However, in the model I do not propose to specify split brasses [redacted] when eventually they need renewing (which with adequate lubrication will not be for [redacted] very long time !), it will be [redacted] quick and easy to rebush the old ones, or almost even to make new ones, [redacted] to adjust the old.

The material to use is either cast-bronze, or cast-gunmetal bar, 1 in. × $\frac{5}{8}$ in. by about $3\frac{1}{8}$ in. or $3\frac{1}{4}$ in. long, and this should be squared up to $\frac{7}{8}$-in. × $\frac{9}{16}$-in. section. If you have [redacted] milling-machine, a shaper, or [redacted] planing-machine, the operation will be simplified, but even for we lesser wights who have to rely purely [redacted] lathes for milling operations, the job need not present much difficulty. Of course, [redacted] vertical-slide will make the task much easier ; otherwise, for the later grooving operations, the work will need to be packed up very carefully to height on the milling-table of the lathe.

Mount the machine-vice [redacted] the vertical-slide, and grip the slab of metal in its jaws ; the wider side should be outwards, with [redacted] piece of parallel packing behind the slab to bring the surface to be milled outside the level of the jaws. I used [redacted] short end of $\frac{1}{2}$-in. × $\frac{3}{16}$-in. brass bar for packing. See that the slab is pressed hard against the latter [redacted] you tighten the vice, of course, and it will help to take the thrust.

Now mount an end-mill or [redacted] flycutter in the mandrel-socket or in the three-jaw chuck—depends whether the cutter has [redacted] taper or parallel-shank—and clean up the face of the work. If using [redacted] end-mill of less diameter than 1-in., either commercial or home-made, you will have to take two or perhaps three overlapping cuts to clean up the whole surface, of course.

Slack off the vice, turn the block through

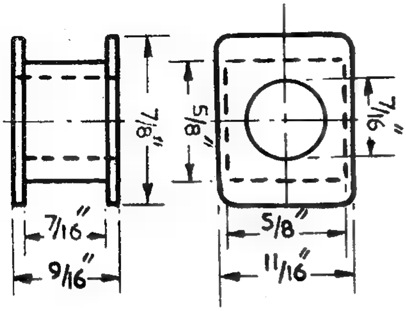


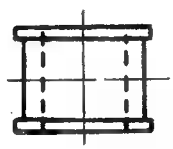
Photograph No. 19. Checking the squareness of the bearing in the vice

Continued from page 720, " M.E.," November 27, 1952.

90 deg., so that the machined surface butts against the fixed jaw, and tighten up again. Mill the outer face, and it should then be at right-angles to the first one.

It is assumed, of course, that you have been





Bearings for crank-shaft and second shaft. The instructions given for machining these can also be applied to machining locomotive axleboxes. (With apologies to "L.B.S.C." and J. I. Austen-Walton !)

careful to set the vertical-slide table *exactly* square with the lathe axis, because if not the ensuing operations will *not* result in a square block.

Turn the metal through 90 deg. again, this time with the wide machined surface pressed hard against the packing and the narrow one against the fixed jaw of the vice. Machine off the outer surface until the thickness is left at exactly $\frac{9}{16}$ in., preferably checked with the "mike."

Similarly, machine the other edge until the breadth of the slab is exactly $\frac{7}{8}$-in., also micrometer checked.

Milling the Grooves

Up to now, it has not mattered particularly about the vice-jaws being exactly square with the edges of the top-slide, but from now on it *does* matter very much indeed. It can be checked easily enough if you grip the machined slab in the jaws and place the scribing-block on the lathe-bed. Set the bent scriber to touch the upper surface at one end, and naturally it should just touch all the way across as you advance the cross-slide. If it doesn't, slack off the clamping bolts of the vice, and tap it one way or the other until it *is* square. If you possess a dial indicator, use this on the scribing block, of course.

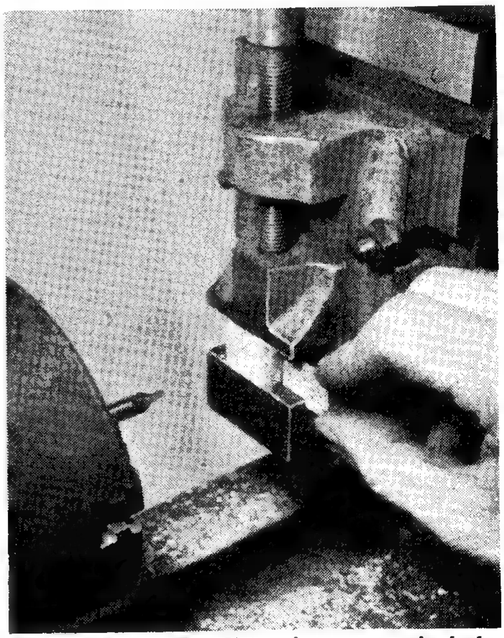
If now you possess a $\frac{7}{16}$-in. diameter end-mill or like to make one, you can mill a groove to that width, and $\frac{1}{8}$ in. deep, down each edge of the slab, leaving a $\frac{1}{16}$ in. wide band on each side of the groove. Alternatively, a smaller cutter may be used—mine was $\frac{1}{4}$ in. diameter—and the $\frac{7}{16}$ in. width removed "at twice." It is preferable to take out the depth in three or four passes, with the cutter revolving fast, than to hog it out in two or three cuts at a slower speed.

If you "miked" the breadth of the slab, you can easily gauge the depth of the groove from successive readings of the "mike" collar on the leadscrew handle—if your lathe is so fitted!

Photograph No. 18 shows how my slab was parted into four, using a $\frac{1}{16}$ in. thick metal saw on a mandrel between centres. You will note that instead of the usual driver-plate, I used the face-plate (with driver-pin inserted) to drive the lathe-carrier. This was to give a larger reference surface for the stock of the try-square which was used in setting the slide at right-angles to the plate, and so parallel with the lathe axis.

The advantage of this method of sawing off the brasses is that the ends are automatically square and dead to length, if care is taken; and much time is saved, too. Pass a rubber band round the driver-pin and shank of the carrier to hold them together, which prevents any rattle.

Alternatively, if you don't possess a cutter of this type, the four pieces may be set out to length, making an allowance for sawing off and facing the ends. Then the pieces are sawn off by hand, and the ends faced up either by end-milling, or in the four-jaw chuck.



Photograph No. 20. Using the gauge to check the position of the bearing for drilling

Following this, the shallow grooves are end-milled 1/32 in. deep in the top and bottom edges of each bearing-block. As it is essential for all the grooves to be square with each other, make sure that the deep grooves are set exactly parallel with the lathe axis before milling the shallow ones. Photograph No. 19 shows how to check this, using a small square, with the face of the chuck as a reference-plate for the stock of the square. Here again the depth of the groove may be gauged by use of the leadscrew micrometer collar; and also the breadth of the groove may be gauged by using the same readings of the vertical slide mike collar as you had when milling the $\frac{1}{8}$-in. deep grooves.

As with locomotive axle-boxes, it is very necessary that the holes for the shafts should be drilled accurately in the bearings. If not, the shafts will bind in them, and will not be parallel. Moreover, since the centres of the shafts will be affected, the gears will not mesh accurately, and if the crankshaft bearings offend, this will affect the distance between centres of cylinder and crankshaft.

Note for Locomotive Fans

However, in this case all we need is a small gauge, filed from a scrap of sheet metal, which takes about two ticks. The procedure is as follows, and is just as applicable to locomotive axle-boxes as to our bearings.

Set out very carefully the centre of one of the brasses, centre-pop it lightly and *accurately*; set the dividers to 7/32 in., and scribe a circle of this radius on the centre. Lightly centre-pop the circle in six places, and it will act as a tell-tale when the hole is drilled—an old tip worth following when any largish hole is to be drilled.

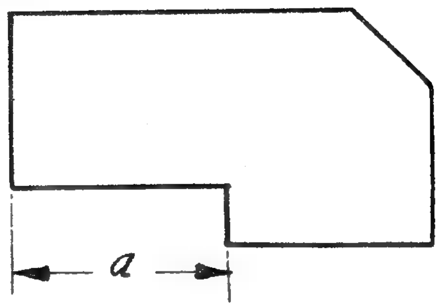
File up a little gauge, as sketched, from a bit of sheet brass or steel, and make length *a* such that when the gauge is used as in Photograph No. 20, touching both the bearing and the side of the vice jaw, the former is approximately in the centre of the jaws.

Now grip the bearing in the vice; see that it fits to the gauge as shown in the photograph, and that it is pressed back against your parallel packing. After tightening the vice, check with the gauge again just to be on the safe side.

Remove the lathe chuck, and plug the centre into the mandrel. Bring the saddle up until the bearing almost touches the point of the centre, and manipulate the cross-slide and vertical-slide handles until the centre-dot on the bearing coincides exactly with the centre-point, sighting from directly in front and directly above. Note the readings on the mike-dials in case you accidentally move one of the handles.

Knock out the centre and replace the three-jaw chuck, gripping in it a centre-drill, switch on, and bring the work gently up to the drill so as to make a slight indentation in the work. Wind the saddle away from the drill, switch off, and check to see that this indentation *is* truly central, using the dividers. Do *not* touch the cross-slide and vertical-slide handles, of course.

If correct, carry on with the centre-drill, and follow up with successively larger twist drills—I used 5/32 in., 7/32 in., and so on up to 27/64 in. Don't drill to final size, $\frac{7}{16}$ in. at this stage, however.



Gauge described in the text

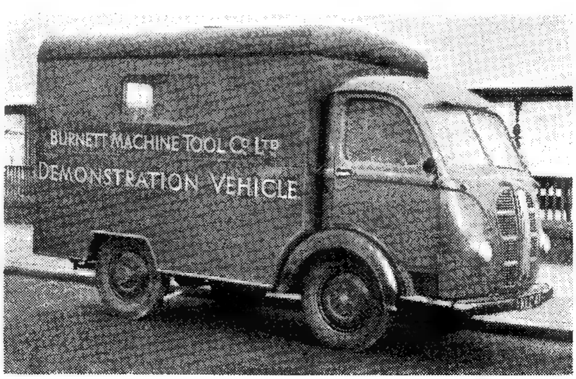
Remove the bearing from the vice, and if you have worked carefully, the hole should be bang in the middle of the tell-tale circle you marked out earlier. Brush away any swarf from the vice, and since the hole will have gone through into the packing, replace it with another piece. (If you don't, the hole in it may throw that in the next bearing wrong slightly.)

Now grip the second bearing in the vice, setting it to the gauge as before—no need to mark it out. Repeat the operations just described, and then do them all again on the third and fourth bearings.

(To be continued.)

Machine Tool Demonstrations

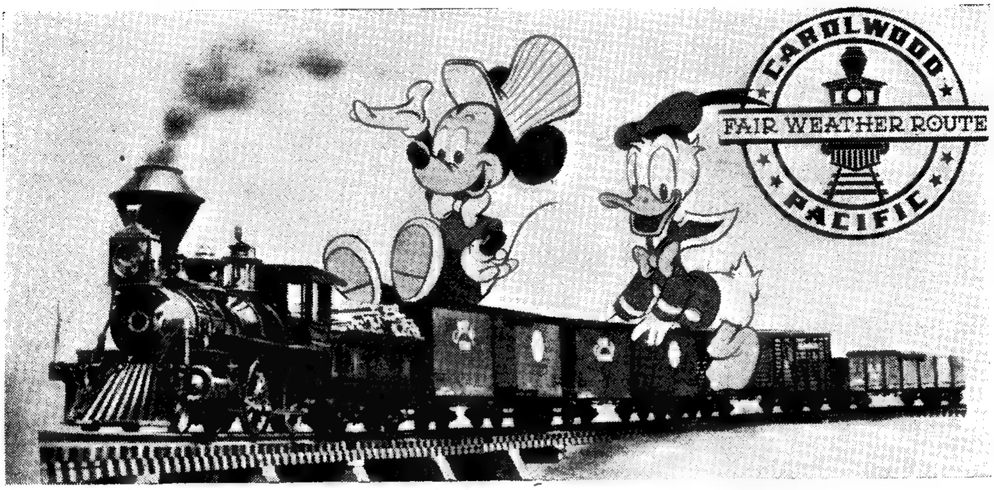
AMONG the interesting features on the trade stands at THE MODEL ENGINEER Exhibition, the demonstrations of the Granville Senior 3½ in. lathe, attracted a good deal of attention, and we are, therefore, interested to learn that arrangements have been made to bring these to the notice of a much wider circle of our readers, by the use of a mobile demonstration unit, which will visit various parts of the country.



The general idea is that this will make a tour taking in the principal industrial towns, and give free demonstrations, both to professional and amateur engineers.

Any of our readers who are interested in this service, and particularly secretaries of model engineering clubs, should write to the distributors of Granville lathes, namely, Burnett Machine Tool Co. Ltd., Burnett House, Myton-gate, Hull. This will enable a definite itinerary of the tour to be arranged, calling in turn at various clubs on predetermined dates.

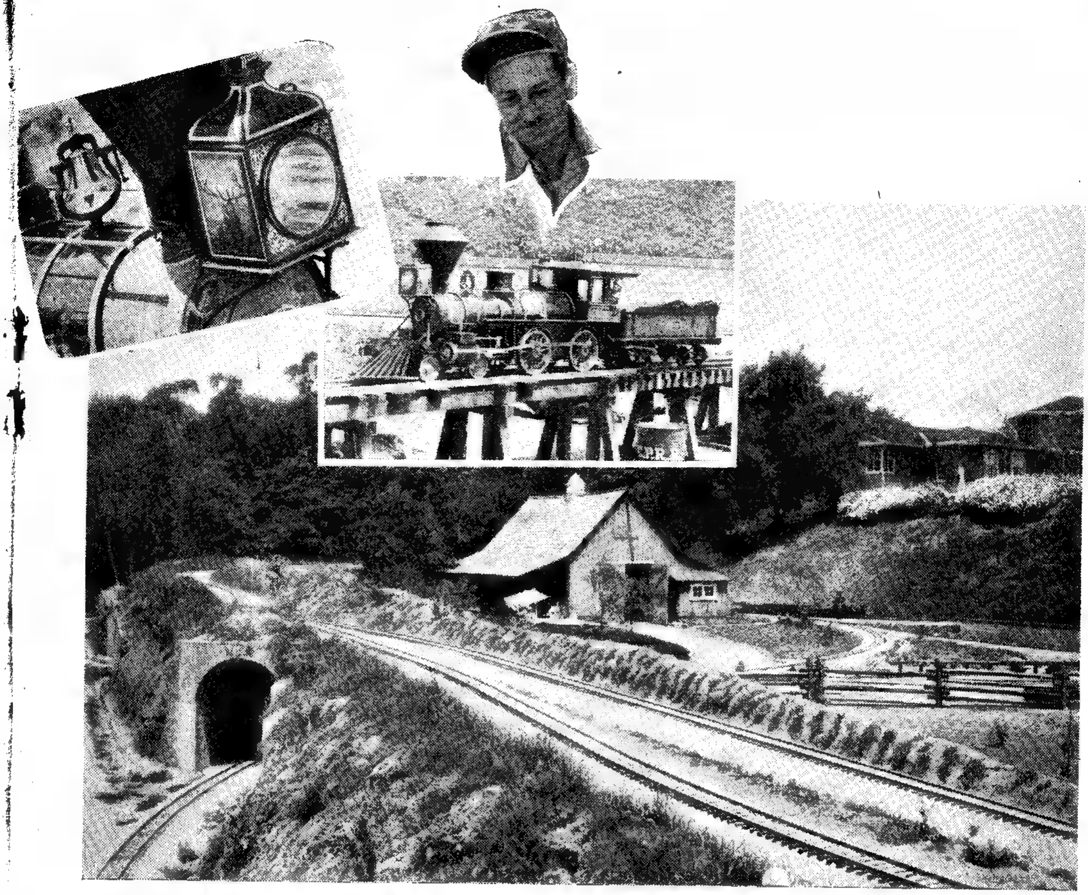
The Carolwood-Pacific Railroad



WE have previously made reference to the above railroad, and readers will recall that it is [redacted] 7½-in. gauge line built and owned by [redacted] of the world's best known personalities, Walt Disney, whose delightful, fantastic cartoon films [redacted] loved by children of all ages wherever there [redacted] cinemas. By the kindness of Dick Bagley and Bob Day, editors of *The Miniature Locomotive*, we are able to present our readers with the accompanying photographs, showing scenes on the Carolwood-Pacific R.R. and some of its equipment, together with the following notes on the line and some " behind-the-scenes " information about it.

Walt Disney's first experience with model railroading came with the construction of a Lionel train layout for [redacted] young nephew's Christmas present. He found that this provided him with relaxation from his many duties as head of his studio, and he continued the hobby

Starting out for a trip



Top left : *Headlamp of No.* 173. *Middle* : *Disney and* 173. *Below* : *General view of the Carolwood-Pacific RR.*

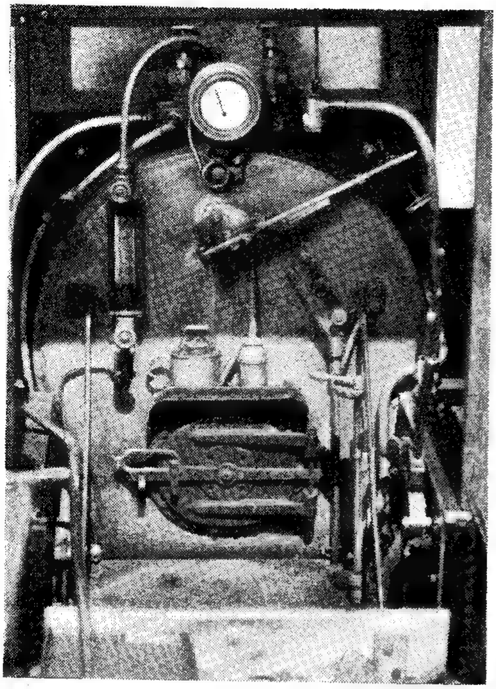
by assembling locomotives and car kits in "HO" gauge for which he started an elaborate layout.

About this time he had his baptism of live steam, in an afternoon on Richard Jackson's 1-in. scale railroad at Beverley Hills. After this "HO" gauge was forgotten and live steam became the order of the day, so far as Disney was concerned! He inspected and operated trains on several miniature railroads before deciding that $1\frac{1}{2}$-in. scale, $7\frac{1}{4}$-in. gauge were the most suitable for his needs. He liked the old-time "diamond stack" locomotives of the 1880s and chose to follow [redacted] prototype typical of California, No. 173 of the Central Pacific RR., built at Sacramento, Calif., in 1872. What an engine! Let nobody say now that it cannot be done!

This delightful little engine, seen in some of the illustrations herewith, is [redacted] exactly to scale as possible. When Disney first contemplated building her, he was surprised to find that among his employees were some that had had experience with steam locomotives, full-size and miniature. Books and photographs of early American railroads were sought out and studied, and from the information gained, plus [redacted] few blueprints from the Southern Pacific files, drawings for the miniature No. 173 [redacted] started in September, 1948. Patterns were made [redacted] the studio prop shop and castings and fittings in the machine shop.

Disney came into the shop and learned to operate all the machine tools by making some of the parts himself. He made the whistle, flag-stands and handrails, laid out and fabricated the headlamp and smokestack, and then made numerous parts in the milling machine and learned to silver-solder or braze on many small fittings. The engine was ready for its first steam trial on December 24th, 1949, and was finally completed in 1950.

The rolling stock consists of six gondolas, two freight cars, two cattle vans and one caboose, all $1\frac{1}{2}$-in. scale copies of stock of the 1872-1880 period. Disney made these, except the gondolas, and equipped the caboose with running lights, bunks, clothes lockers, magazine rack with miniature newspapers, desk lamp, washstand and [redacted] pot-bellied stove. All these cars are mounted on arch-bar trucks made up just as the prototypes were built. Some trouble [redacted] experienced because tolerances were too fine—the manufacture of railway rolling stock is in rather a different category from that of motion picture cameras and film equipment, most of which have very close tolerances!

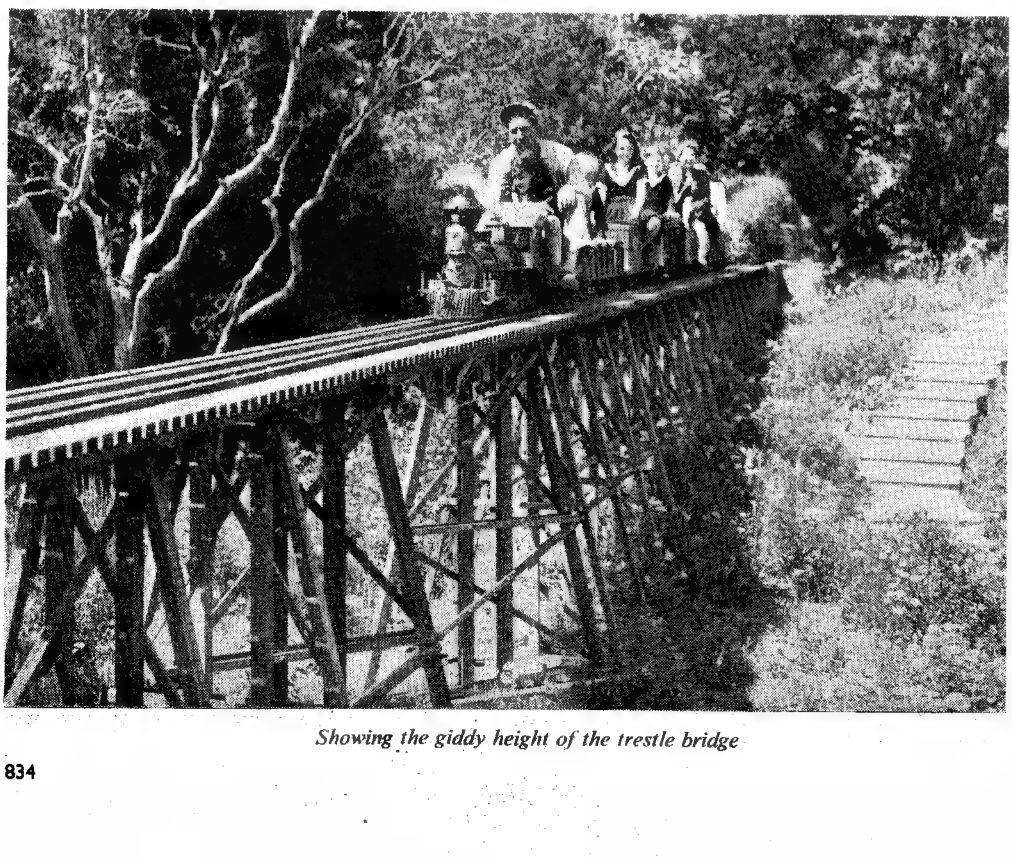


Footplate fittings of No. 173

The layout at Disney's home in Beverley Hills extends to 2,600 ft. of track laid out in a scenic pattern of trestles and tunnels along the edge of a canyon wall. The task of building it was approached as it is in full-size practice; but this idea was abandoned, because what is called the "Lionel Method" was found to be more suitable for the purpose. The layout was plotted on paper, to the scale of 1 in. to 20 ft. Templates to the required size were made in 10-ft. lengths in tangent and in radii from 45 ft. to 60 ft. in 5-ft. steps and 100 ft. radius, two templates of each being required. These were laid on the ground, starting from the crossover point, and a record was made of the lengths of tangent and curved sections required to make the track go where the paper layout indicated. The 10-ft. lengths were used wherever possible because the rail was supplied in sections of that length.

The rail was rolled to the necessary curvature in a set of motor-driven rollers shaped to fit the rail contour. It was then spiked to redwood ties (sleepers) in jigs; the ties were of scale section and length, rabbetted for rail seating and spaced to scale. The spikes were dipped in a resin coating to make them hold tightly in the ties. The rail was laid in sections with a 3-in. offset, and the track was bolted together in place on top of 2-in. of crushed rock ballast. Then ballast was added between the ties and tamped into place.

The first part of the layout was laid in December, 1950, and consisted of a complete loop with



Showing the giddy height of the trestle bridge

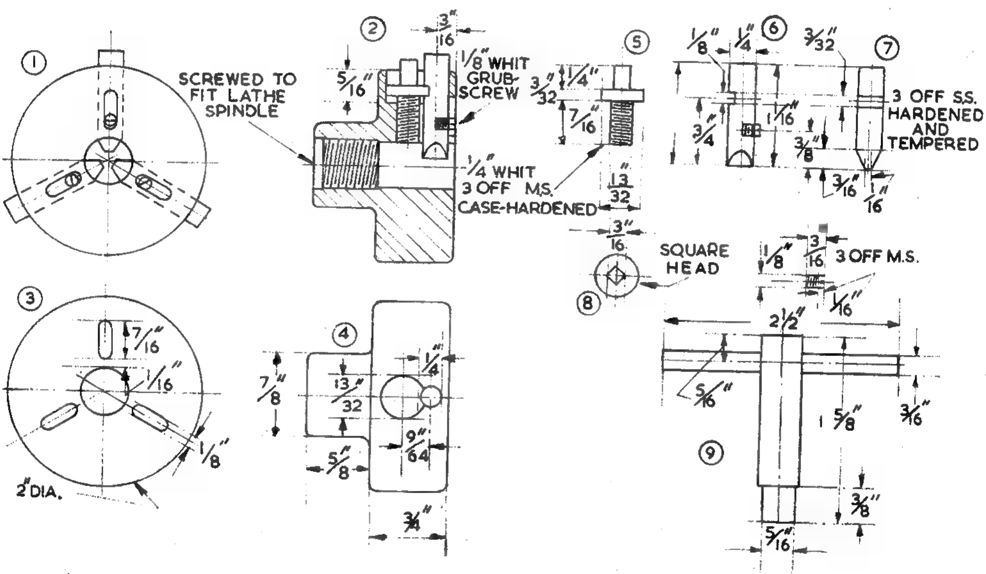
a figure [redacted] inside, one passing track and one siding. It required eleven switches and one crossover to join all these sections togehter, and the total length was 1,200 ft. Subsequently, [redacted] long loop of 1,400 ft. was added ; it climbs from the lower loop with two connecting curved sections having 3 per cent. grades. This upper loop crosses a 65-ft. trestle which is 9 ft. above the track it passes over and runs through [redacted] 90-ft. tunnel. The combination of track, bridges and tunnel [redacted] necessary because of the contour of the land ; but it enables [redacted] train to move in either direction, over any part of the track, [redacted] total distance of 5,000 ft. without passing twice over the [redacted] track in the same direction.

A new locomotive, similar in style to No. 173 but of 4-6-0 type is being built ; but we were interested to learn that, when Walt Disney [redacted] in England last summer, he acquired a $1\frac{1}{2}$-in. scale G.W.R. " King " class engine, which will make [redacted] intriguing contrast with No. 173 and her 4-6-0 sister. That " King " will have [redacted] much more extensive track [redacted] which to show her paces than she has had hitherto !

A Three-Jaw Independent Chuck

THE body of the chuck I am about to describe was made from cast-iron and has, during the past twelve months, stood up to its job exceedingly well. The jaws will admit work from $\frac{1}{8}$ in. to $\frac{1}{2}$ in.

First, obtain [redacted] suitable piece of stock, bore and screw to fit your lathe spindle and turn all over to the given dimensions. Next, divide the periphery into three equal segments, drill three $\frac{1}{4}$ in. holes for the jaws $\frac{3}{16}$ in. centres from the face, and ream. At the same setting, drill the three $\frac{1}{4}$-in. Whit. tapping size holes and counterbore 13/32 in. for the screw collar, [redacted] that both screw and jaw will be in line.



On the face of the chuck, cut three slots $\frac{1}{16}$ in. from the edge of the centre hole, $\frac{1}{8}$ in. $\times$ $\frac{3}{16}$ in. long, then make three mild-steel screws (Nos. 5 and 8), the collars of which should be just a sliding fit in the counterbore, and remove all sharp edges before case-hardening.

The jaws, Nos. 6 and 7, are $\frac{1}{4}$-in. round silver-steel, both ends of which should be squared in the lathe. Each side should be bevelled about $\frac{3}{16}$ in., leaving the tip about $\frac{1}{16}$ in. wide. Now, $\frac{3}{8}$ in. from the end of each jaw, cut a slot 3/32 in. wide and $\frac{1}{16}$ in. deep for the screw collar to work in.

On the opposite side of the jaws and $\frac{3}{8}$ in. from their ends, drill and tap $\frac{1}{8}$-in. Whit. holes to take the $\frac{1}{8}$-in. grub-screws. On assembly make sure that these lie flat with the chuck face when they are screwed well home.

After the jaws have been hardened and tempered [redacted] dark straw, you will be able to complete your assembly. The key, No. 9, is self-explanatory.—A. HOBBS.

Mrs. Model Engineer

by Herself

A modeller's life is full of care
And this his worthy wife should share.
The metal filings on the floors,
The oily fingerprints on doors,
She must accept with patience mild
And bear with this precocious child.

The boats that in the bath do ride,
The blueprints scattered far and wide,
Must be to her a source of pride,
And never, never *must she chide.*

Should things go wrong, or models fail,
To function for her super-male,
The language drifting through the air
With Billingsgate might well compare.

A first-aid kit she needs nearby,
For boilers burst and splinters fly !
She yet must smile and bear it all
For she is lost beyond recall.

A modeller's wife should be a saint !
I much regret to say—I ain't !

An 8-mm. Cine-Projector

by G. Starre (Holland)

THE film in the film-channel is actuated by a claw of ■ special design, which is driven by a cam on the main-shaft. Details of this system are given in Fig. 5. The cam must fit the square hole in the claw with as little clearance as possible, as the better this fitting, the more silently the projector runs. The outer end of the claw, which projects through the perforation on the film, describes a rectangle when in motion, moving forwards, down, backwards, and up. The two holes of $\frac{1}{4}$ in. diameter on both sides of the cam frame decreases the weight of the claw.

Photograph No. 4. Showing the cine-projector in the case, along with the screen in the lid

The claw moves between two circular plates, one of which has a hub for tightening on the shaft, and the plates are held together by a bolt passing through a small hole in the cam. As the thickness of the cam is 0.0804 in., the claw is always movable between the circular plates. On the right-hand side the claw is guided on an eccentric shaft. The object of the eccentric is to adjust the relative position of the claw, and thereby shift the film picture in front of the gate; in other words, for "frame correction."

The Guide Roller

The film from the lower end of the film-channel passes round the pin at the hinge of the lamphouse, and is guided, by an obliquely placed roller, to the take-up spool. This roller has a profiled shape to avoid damaging the film.

The take-up spool is driven by a spring belt from the main shaft, which may be adjusted by means of ■ tension roller. The tension on the film should be such as to wind it loosely on the spool.

The Optical System

The optical system is somewhat different from that usually employed. The beam of light from the lamp is reflected back by ■ mirror, through the picture gate. No condenser is used, as the picture gate is so small that an equally illuminated picture field can be attained without one. This is demonstrated in Fig. 6. The mirror has ■ focal distance of $1\frac{1}{2}$ in. and is made of brass, silver-plated and polished. The focal distance of the objective is 1 in., and gives a picture measuring 2 ft. × 2.5 ft. with ■ throw of about 13 ft.

By the following formula the picture height may be calculated:

$$A = F + \left(F \times \frac{P}{p}\right)$$

where A = throw, P = picture height, p = filmgate height, F = focal distance.

For use in the home it is convenient to use the small screen built into the case. This arrangement is shown in photograph No. 4. For focussing, the objective is fixed to an old microscope tube with a rack and pinion, which is attached to the projector case.

The lamp has a short compact filament, and a low voltage type gives the highest efficiency. In the projector described, a lamp for 10 volts and 7.5 amps. was used (Phillips type 6156N)t Other types may be utilised, according to the transformer that is used, and even with ■ 30 wat. lamp, good results can be attained.

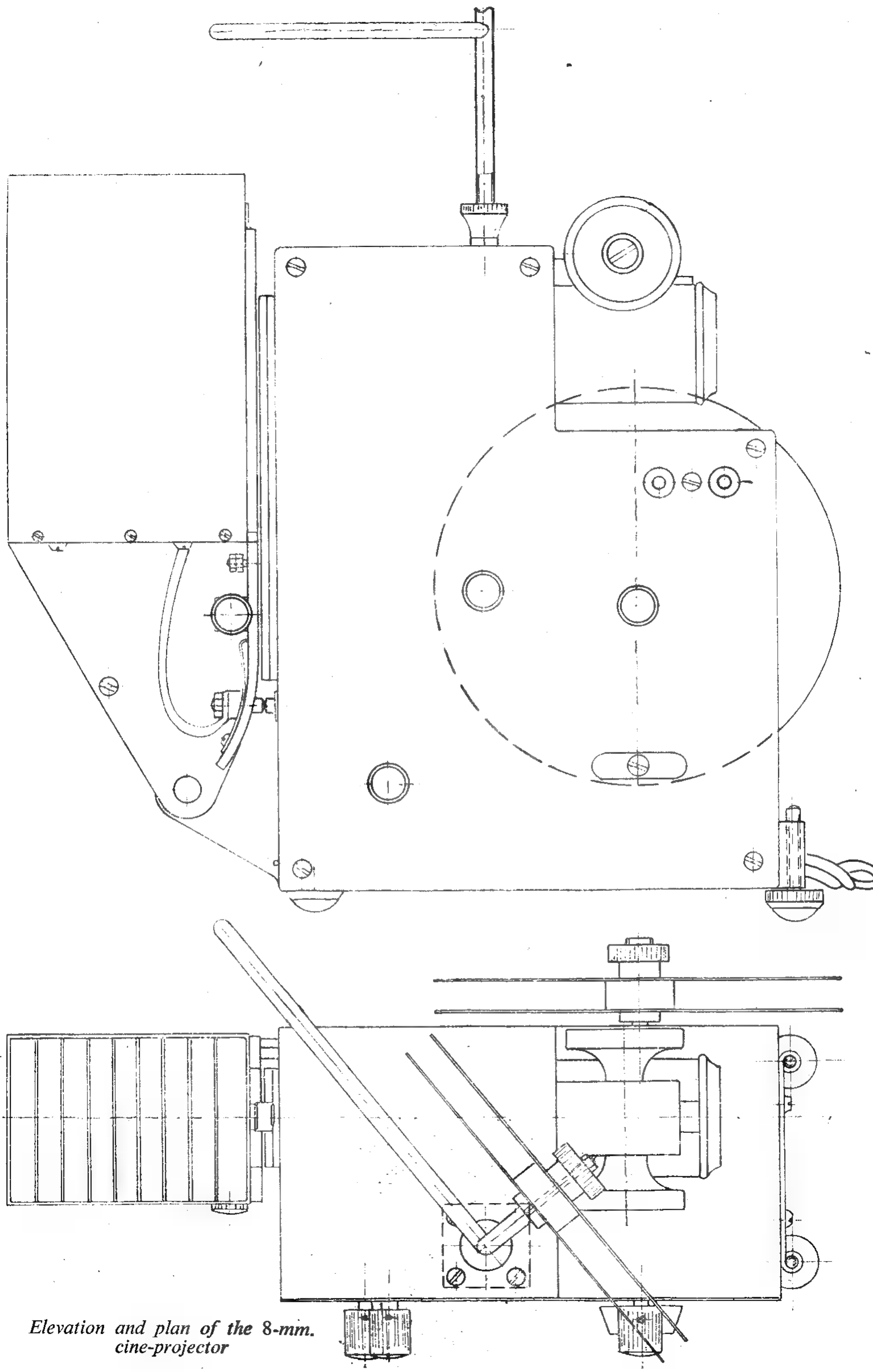
The Shutter

The shutter is inserted in the optical system between gate and objective, and consists of three blades. The use of more than one interruption serves to increase the "flicker" frequency, and render the flickering less obtrusive in the eye. All the interruptions must be of equal angular length. Fig. 7 shows the process of transport during one operation.

Driving Mechanism

The driving mechanism consists of an electric motor of the series type, which takes 150 milliamps and 125 watts, having a three-pole rotor with ■ diameter of 24 mm. and which is fitted with ■ disc commutator. The stator is of an open type with one exciting coil, and the speed

Continued from page 802, "*M.E.,*" *December* 18, 1952.



Elevation and plan of the 8-mm. cine-projector

of the motor is regulated by ■ series rheostat. This motor drives the main-shaft by way of ■ spring belt with ■ transmission ratio of one to four. The speed at which the main-shaft rotates should be 16 revolutions per second, or 960 rev./min.

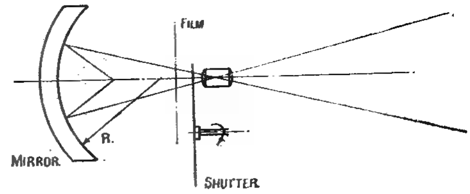


Fig. 6

Speed

To determine the speed, after mounting the projector, the best way is to run through a length of film, marked at intervals of 3 ft. and time the passage of it. The time required to transport 3 ft. of film should be 15.5 seconds. On the main-shaft a gearwheel is mounted which operates another gearwheel on the shutter shaft with ■ transmission ratio of one to one.

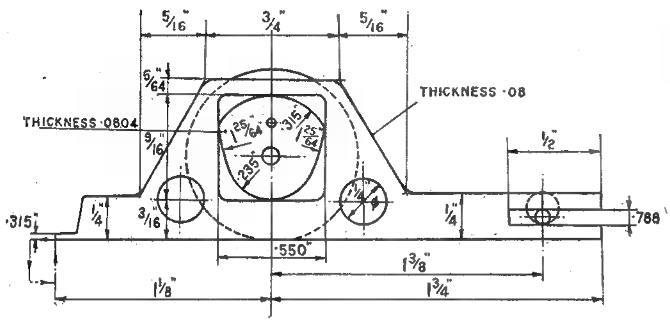


Fig. 5

Electrical Equipment

The line voltage is connected to a separate transformer, and a four-way switch is fitted to control the various circuits. A full potential of 10 volts can be obtained from the secondary windings, though a lower voltage may be tapped off, for projecting a still picture. To obtain the right potential for use in individual cases, the transformer is provided with more tappings, round about ■ volts.

The multipolar switch has four positions, as follows :—1. Voltages on plug connection : projector off ; 2. Lamp lower voltage for still picture : motor off ; 3. Lamp full voltage : motor on ; 4. Lamp off : motor on (for rewinding the film, which does not pass through the film-channel in this case). The multipolar switch has four sets of contacts, and has been specially rebuilt for this purpose. This is shown in Fig. 8.

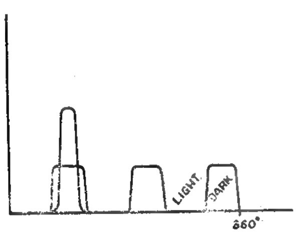


Fig. 7.

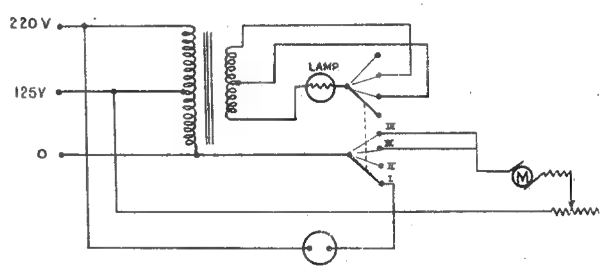


Fig. 8

General

On the bottom of the projector are four rubber feet, on which the two foremost may be adjusted in order to locate the beam of light on the screen. The apparatus is housed in a case in which several film-reels may be packed, and which contains ■ small screen in the cover. This arrangement is shown in photograph No. 4. Within the case there is another simple feature, a length of cord about 15 ft. wound round a small board. On the cord are knots every 3 ft. to enable the throw to be easily measured.

Controlling Knobs

The projector has, on the right-hand side, four knobs for frame correction, speed control, main switch, and motor shaft respectively. With this last knob, the projector can be set in the right position to receive the film. For putting in the film with one hand, between the opened lamphouse and the body, under the film channel, a rectangular pin is mounted which fits into the perforation of the film. The film may be held in the film-channel with one hand by fixing one end of the film on the pin, while the lamphouse is being closed with the other hand.

[*Editorial Note* : If any readers should be building replicas of this very neat projector, so admirably described by our Dutch friend, we would be glad to hear from them and to see illustrated descriptions of their work.]

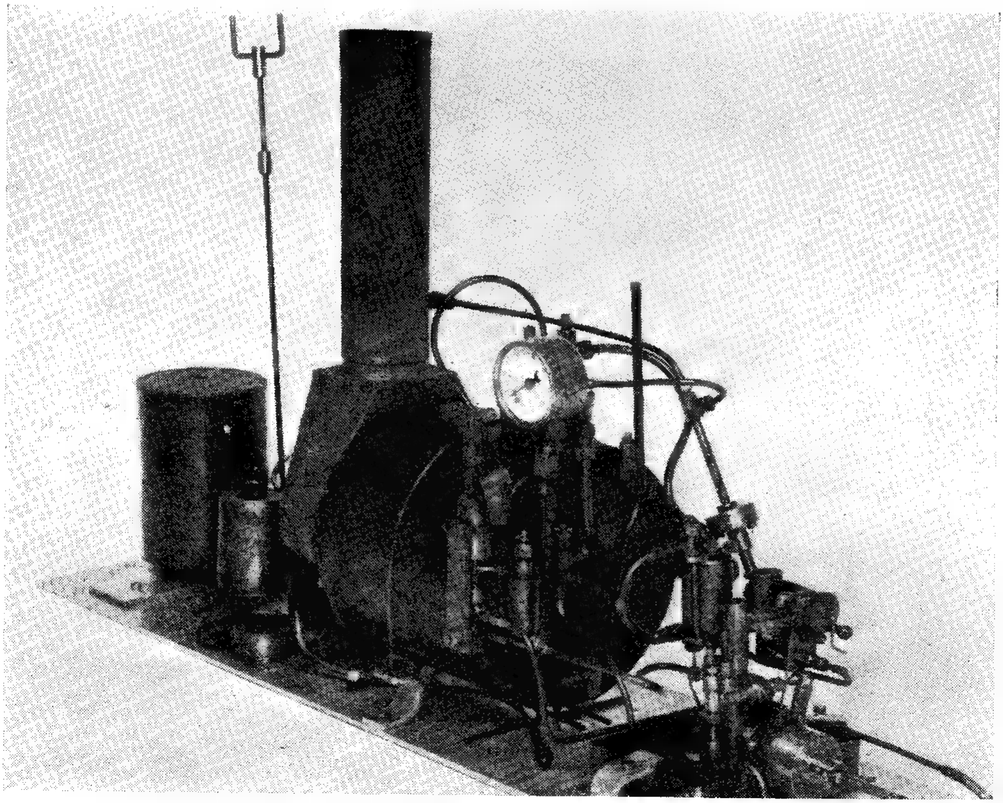
An Automatic Steam Plant

Incorporating feed regulation and an atomising burner

by J. F. Croll

HAVING decided the jets required and borrowed ■ reamer (nobody would ever do more than show me his injector once without letting go), put ■ piece of ¼-in. hex. brass in the three-jaw chuck, screw the end $\frac{3}{16}$ in. × 40 for ⅛ in. Make a rough scale sketch of the reamer and remembering that the sizing hole is ⅜ in. inside the bar judge how far you can go with ■ drill the maximum size of the reamer so that no step will be left. (Fig. 11.) Then judge how far you can go with the smallest drill you have if it is larger than the desired jet, again so that no step is left after reaming. If the jet is to be larger than the drill, the drill should go in $\frac{7}{16}$ in. Drill into the end of the bar the distances just found or a little (1/32 in.) less. The reamer may be used now in the tailstock with plenty of oil and ■ few thous. at a time. If it does not cut freely try honing the flat of the " D." These reamers cut most freely at something under the half circle. Where the point has to go beyond the drilled hole make sure the end has the proper cutting slant (10 × eye-glass) and push the thing in ⅜ in. Part off the jet from the bar with ■ tool 5/32 in. wide set or ground to ■ slant so that when the end of the edge nearest the chuck reaches the hole or centre the end of the edge further from the chuck has

Continued from page 805, " *M.E.*," *December* 18, 1952.



Photograph No. 5. Reading from left to right, there is the fuel container, the donkey boiler ; on the nearest point of the boiler is the steam-operated bypass valve. Next is the air vessel on the feed pump line. The feed pump is across the main column of the engine. The reducing valve is just above the engine

left a tapered pip 3/32 in. at base (Fig. 12). Note the jet externally has $\frac{1}{8}$ in. of $\frac{3}{16}$ in. thread, $\frac{1}{8}$ in. of $\frac{1}{4}$ in. hexagon and $\frac{1}{8}$ in. of taper point. The parting groove is also the taper point. I prefer to do the reaming after parting off with the reamer in the three-jaw chuck and the jet in hand. This method is more sensitive and if the jet is larger than the reamer point it can be watched until sufficient projects to show that the desired size is reached. Set your micrometer to the jet size, poke the reamer between the jaws and however far it goes in with the taper edges touching the jaws it must project from the jet by that amount. With the jet reamed to size put it in the three-jaw and if a fuel jet round off the end with a smooth stone until a slight flattening round the hole is obtained. With a steam jet do not stone but insert the reamer and slightly open the mouth of the hole. This feature is essential for two reasons (1) the small amount of condensate which occurs after the trap will blow off sideways without blocking the jet (2) the expansion of the steam has the injector action of pumping a stream of air to draw fuel and support combustion. I cannot give exact measurements for the reverse

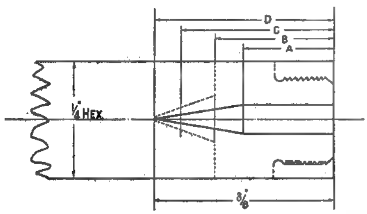


Fig. 11. Drilling diagram. "A"—$\frac{3}{16}$ in. deep—$\frac{1}{16}$ in. drill; "B"—$\frac{1}{4}$ in. deep—No. 60 drill; "C"—$\frac{5}{16}$ in, deep—No. 75 drill; "D"—$\frac{3}{8}$ in. deep—reamer

taper depth as it is very small but to allow for the flattening of the fuel jet and the reverse taper of the steam jet both should be reamed slightly below size to start with.

With the new jets screwed into their carriers, the

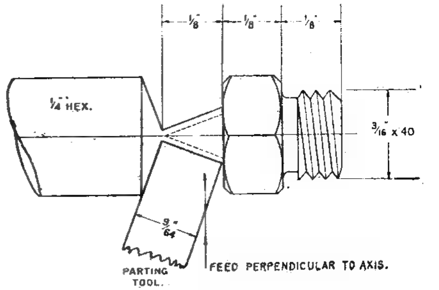


Fig. 12. Forming the jet

fuel jet screwed down to the hex. and the steam jet until it reaches the bottom of the thread and forms a continuous bore with the inner hole of its carrier, we are ready for air and steam tests. To set the jets adjust bush and lock nuts until the steam jet projects over the fuel jet, leaving the lock nuts just slack centre with side screws then withdraw steam jet to $\frac{1}{16}$ in. behind fuel jet and

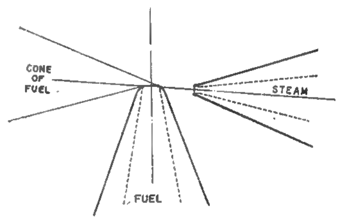
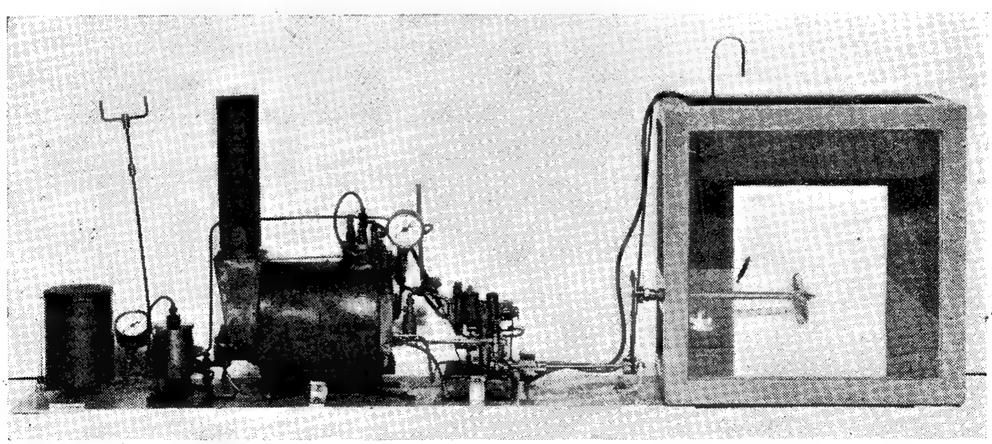


Fig. 13. Relative position of jets, showing approximate nozzle shapes

tighten nuts. (Fig. 13.) Bring up steam jet by turning bush until top is level with centre of steam jet. Connect steam jet to valve on boiler in steam and fuel jet to fuel container with level just below that of the jet which may be at any convenient angle in which the control bush can be turned. Turn on steam slowly and if fuel is not



Photograph No. 6. The automatic steam plant arranged for exhibition

lifted turn bush till it is, when the cloud of atomised fuel appears apply light. If the mixture is weak and only burns while a light is applied raise fuel jet. If too rich lower jet. The hottest flame is blue slightly flecked with white. Purple is weak and yellow is rich and productive of "poison gas."

We now have a burner of great power and compact flame which can be turned on and off and up and down as easily as a gas fire giving maximum efficiency at any level. The burner will lift fuel several inches but as the mixture will weaken as the fuel falls a small float chamber or a bird bath type feed should be arranged.

To make the plant independent of other sources of heat for starting, a foot pump may be used or a meths. donkey boiler. My demonstration set has two valves at the back of the steam trap, one to the boiler for steam the other to a shim brass vertical boiler 2 in. long, $1\frac{1}{2}$ in. diameter, connected by 3 in. of $\frac{1}{8}$ in. copper tube (by the way, this size is adequate for both steam and fuel). This donkey is two-thirds filled with meths. and an open meths. lamp is lit underneath; a tin lid will do. The donkey boils in a few seconds and meths. vapour acts as steam and brings the heavy fuel up to light the main burner. The donkey gives up to 25 lb. per sq. in. and by the time the donkey pressure falls away the main steam can be turned on and the steam trap opened. *Caution*: As the trap is opened, there will be quite a flare as condensed meths. is washed out but it lasts only a few seconds. Remember to shut off the donkey valve before the steam pressure rises and bursts the donkey. Silver-soldered 0.008 in. shim brass of the above dimensions will carry over 30 lb. per sq. in., but a 20 lb. safety-valve would be a safeguard.

To make the burner self-regulating, a reducing valve (Fig. 14) must be put in the steam line the wrong way round with boiler pressure direct on the diaphragm, then as the pressure falls the spring opens the valve. With a correctly adjusted valve, pressure in the boiler can be held within 3 lb. from no load to full load, only dropping this amount when the load is suddenly applied. A working pressure of 5 lb. below the safety setting can be used without blowing provided a feed pump is operating. On the demonstration plant the cut-in of the feed pump, closely followed by increase in burner output, was fascinating to watch. The reducing or regulating valve used had a $\frac{1}{2}$ in. diaphragm of which $\frac{1}{4}$ in. diameter was free to move the 10-B.A. spindle operating the valve on a 5/64 in. seating. Keep the valve diaphragm downward so that condensate covers the rubber. A 2-in. long steel tube connected the valve and diaphragm chambers to help keep the latter cool.

Where a limited combustion space or tortuous flue ducting make induced draught desirable a jet pointed upwards in the funnel, connected to have the same pressure as applied to the burner, will automatically give correct variation of draught at all output levels. The jet size will depend on the flue system but half way between steam and fuel jet sizes is a guide.

The burner will take any light fuel from diesel oil and paraffin to commercial petrol or meths. but the latter is a poor fuel. It will not take highly volatile lighter spirit owing to gassing in the hot fuel jet.

The position of the steam jet has been given as $\frac{1}{16}$ in. behind the fuel jet, but with various examples of the burner, the best position has been found to vary from $\frac{1}{8}$ in. to just touching. The varying of this distance can compensate for slight variations in jet construction. The closest position may help to lead condensation away but care must be taken not to force the jets together or the blunt fuel jet may damage the knife-edged steam jet or even close it.

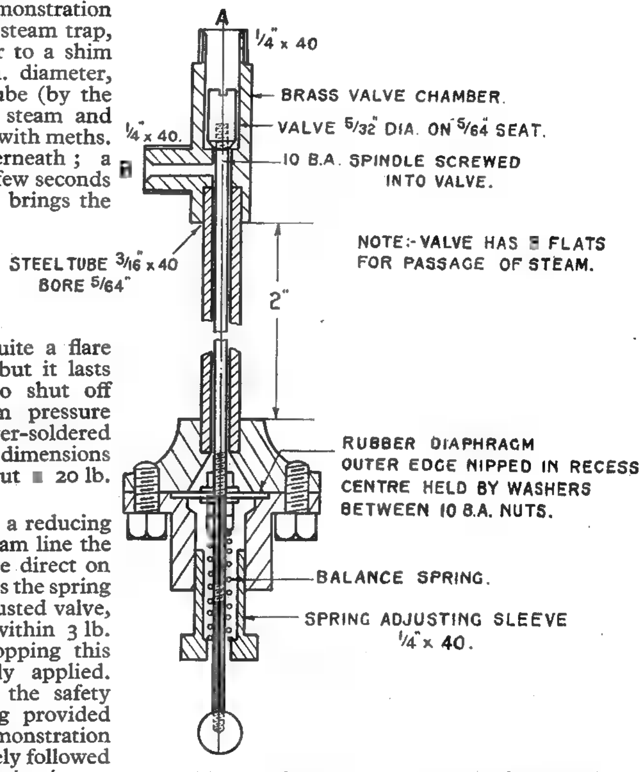


Fig. 14. Reducing or inverse regulating valve. Steam admitted at "A" gives reduced pressure at "B." Steam admission at "B" gives pressure at "A" varying inversely to boiler pressure

It is a long story and attention to detail is necessary, but I could make up a burner and steam trap in an evening. Control valve float chamber and donkey boiler would need another evening each. The automatic feed device needs a steam dome with lid placed where the float can have $\frac{3}{4}$ in. of water to float in unobstructed by stays and tubes.

Note. Superheating the steam is no help with a burner which persistently cuts out owing to water. For this fault try another steam jet with a different flare at the exit.

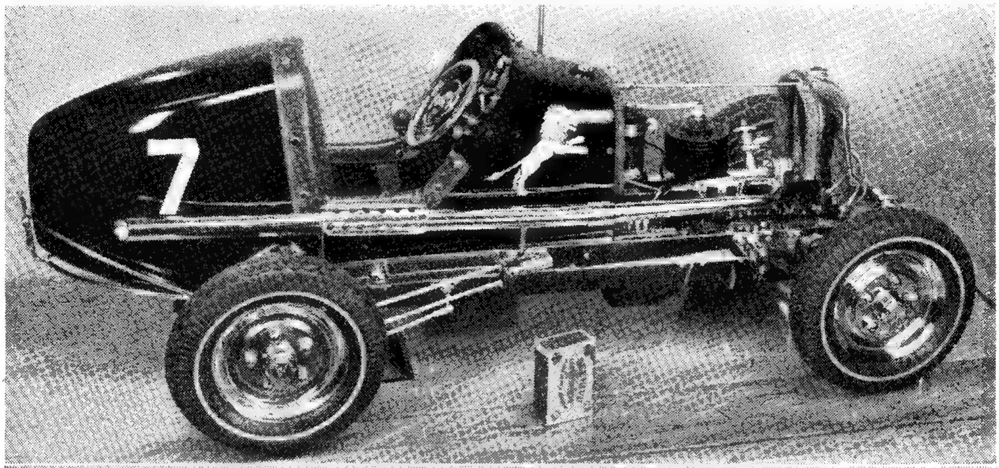
A SCALE MODEL MIDGET RACING CAR

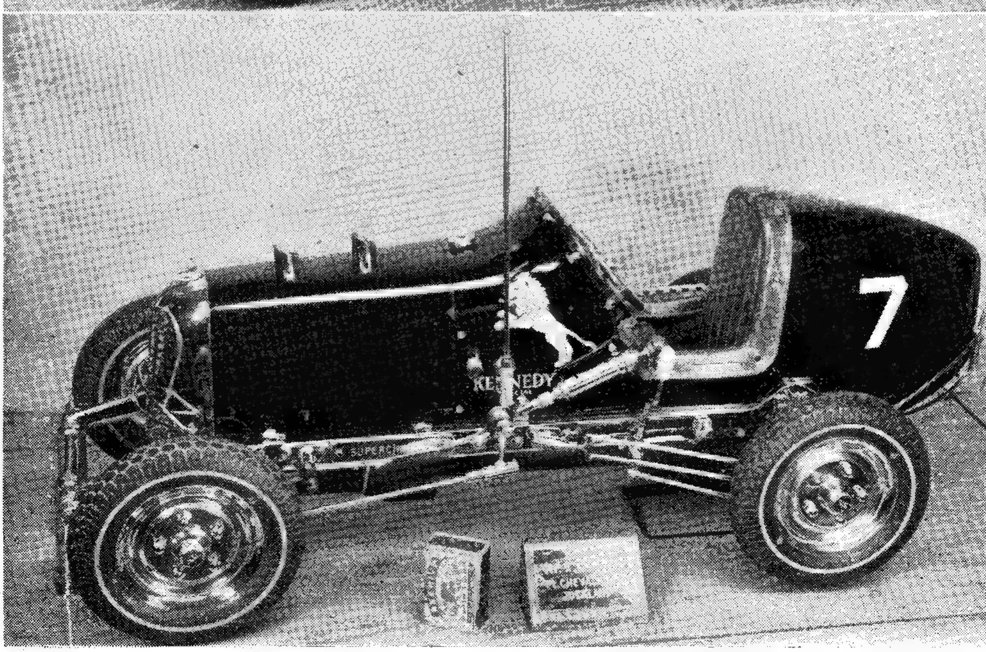
FOUR years ago, Mr. Ray Kennedy, a carpenter of Point Chevalier, New Zealand, decided to build a model which, as far as he knew, would be the only one of its kind. He had always had an ambition to become a midget racing car driver, but this was frustrated by the war, and by way of the next best thing, he obtained details of an American midget car and built a replica of it in one-quarter scale.

The result of his enterprise, shown in the photographs, contains nearly a thousand bits and pieces, and occupied 5,500 hours of work. Its dimensions are 26 in. long, 11 in. wide, and 11 in. high, weighing 50 lb. all on. A British-made engine, by Gerald Smith, is fitted, but it is not intended to be used as a racing model.

Mr. Kennedy has built several other models of various types, but this is his most ambitious effort up to date. He is now preparing to build a working model motor-cycle, which, he estimates, will take about two-and-a-half years to complete.

All the machining on the car model was carried out on a Myford M.L.7 lathe, and we are indebted to the Myford Engineering Co. Ltd., for bringing to our notice this truly outstanding example of model craftsmanship.





Thermometer Scales

by S. F. Weston

THERE are three thermometer scales in use in the British Isles and on the Continent: Fahrenheit, Centigrade and Réaumur. The differences between the three scales are that on the Fahrenheit scale there are 180 divisions between freezing and boiling points, whilst the Centigrade scale has 100 divisions and that of Réaumur 80 over the same range.

For scientific purposes the Centigrade scale is most frequently used, but the Fahrenheit scale is often substituted and is in general use for British domestic purposes. The Réaumur scale is seldom used in Britain but is in use for medical and domestic usage in some European countries.

A chart is given herewith on which the three scales are shown diagrammatically. On this it is assumed that the bores of all the three tubes are equal and true and the distance between the freezing and boiling points is shown on all three of exactly the same length.

The lines showing each 10 deg., or divisions, of the Fahrenheit scale have been plotted across to the other two scales, and these lines will show at a glance a very near approximation of the corresponding reading on the Centrigrade and Réaumur scales comparable with the Fahrenheit reading. Similarly, other lines could be drawn from either scale to give comparative readings on the other two. For more accurate conversion calculation has to be used.

It will be known that the freezing point on the Fahrenheit scale is 32 deg. The zero reading on this scale represents the lowest termperature that can be obtained by mixing snow and salt. On the Centigrade and Réaumur scales the freezing point is zero in both cases and the lower temperature represented as zero on Fahrenheit scale is known as minus reading on Centigrade and Réaumur scales.

Therefore to compare the three scales we have

	F—32	: C	::	R
or	180	: 100	::	80
or	9	: 5	::	4

This gives us the formula

$$\frac{(F-32)}{9} = \frac{C}{5} = \frac{R}{4}$$

This very simple formula is all that is necessary to enable the calculation of accurate conversion from one scale to another to be made.

As examples :—

What reading on Réaumur scale equals 70 deg. Fahrenheit?

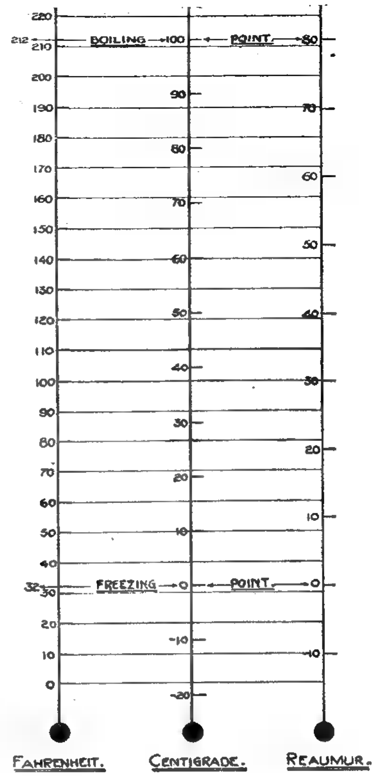
$$\frac{(F-32)}{9} = \frac{R}{4}$$

$$\frac{(70-32)}{9} = \frac{R}{4}$$

$$\frac{38}{9} = \frac{R}{4}$$

$$4.22_2 = \frac{R}{4}$$

$$R = 16.88^\circ R. \text{ Say } 16.9\,R.$$



Again :—

What reading on the Centigrade scale equals 50 deg. Fahrenheit?

$$\frac{(F-32)}{9} = \frac{C}{5}$$

$$\frac{(50-32)}{9} = \frac{C}{5}$$

$$\frac{18}{9} = \frac{C}{5}$$

$$2 = \frac{C}{5}$$

$$C = 10^\circ C.$$

Finally :—

What reading on Réaumur equals 40 deg. C.?

$$\frac{C}{5} = \frac{R}{4}$$

$$\frac{40}{5} = \frac{R}{4}$$

$$8 = \frac{R}{4}$$

$$R = 32^\circ C.$$

It will be seen how very simple the calculation is and that it is a very easy formula to memorise.

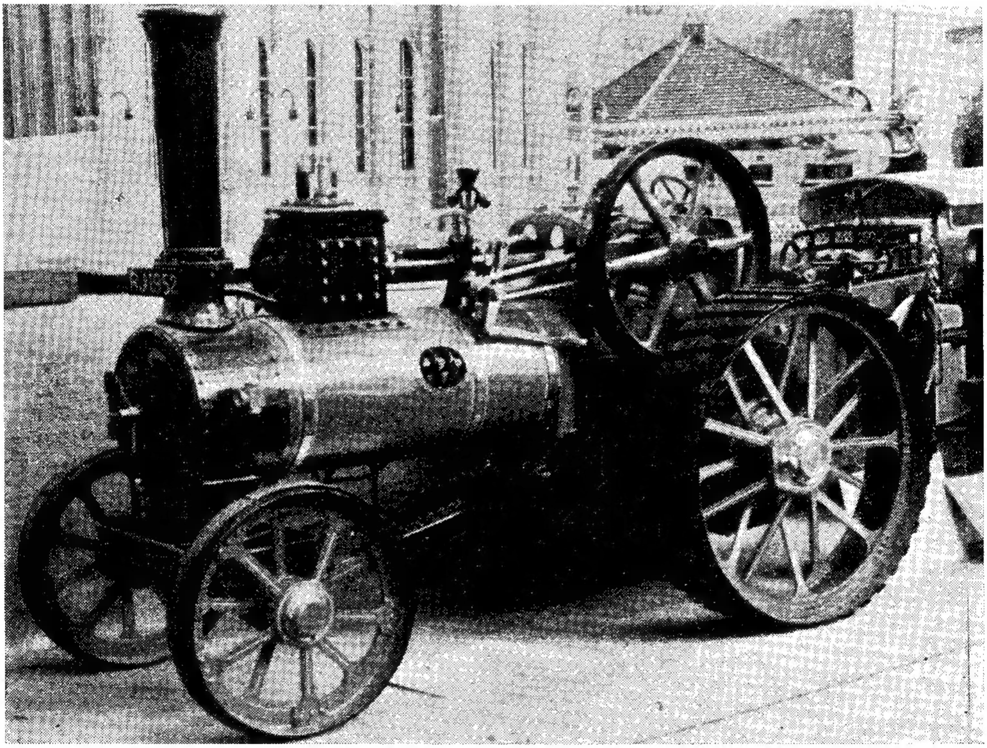
TRACTION ENGINES
at "The Model Engineer" Exhibition
by W. J. Hughes

G. R. JEFFRIES was awarded a "Highly Commended" diploma for his 2-in. scale engine, which was of a Marshall 7 n.h.p. general-purpose traction-engine, *not* a tractor, as wrongly stated in the catalogue. This model was a very good representation of the full-sized machine, and from certain indications I imagine (though I may be wrong!) that the builder has had access to his prototype.

For example, the model is fitted with coal-rails, which were not standard on the Marshall, and even if fitted as an extra by the makers, were quite different in appearance from those fitted by Mr. Jeffries. But if he *has* modelled from an actual full-sized engine, then quite possibly its coal-rails were made for the owner by the local blacksmith as an afterthought. One sees a lot of non-standard work on traction-engines!

Continued from page 762, "*M.E.*," *December* 11, 1952.

Another indication is that the strakes on the hind wheels extend right to the edges of the rims. This is wrong for a new engine, the strakes of which should be stopped at about a scale ⅜ in. from the edges. However, when the wheels have been pounded on the roads for some time, the strakes may well have stretched to that extent owing to the hammering they have received. This is the reason for them being stopped short in the first place, of course: if not, it would not be long before they extended dangerously beyond the edge of the rims.



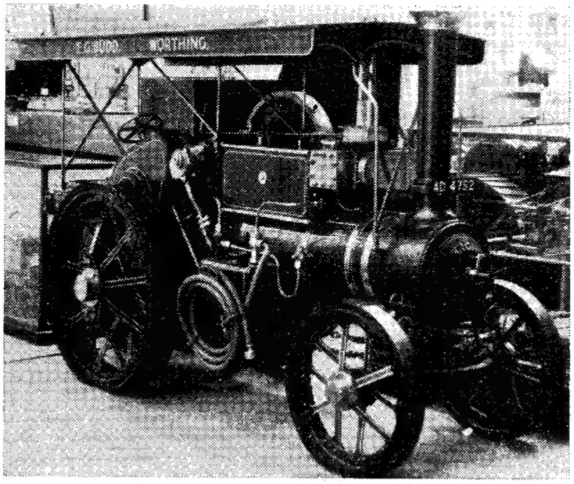
The 2-in. scale model of a 7 n.h.p. Marshall traction engine, built by G. R. Jeffries, which was Highly Commended

However, to return to the model, all the patterns had been made by the builder, as well as almost everything else, including nuts and screws. Which reminds me that the nuts for the glands should be steel, not brass, and the front axle should pivot in its fork on a pin, and not on a nut and bolt.

Other criticisms concern the brass bevel-gears driving the governor, the vee-thread on the

brake spindle, and the lamps which appeared too small for the scale. The finish, too, was not quite up to the standard set by the models described earlier, but that was *really* something, as the reader will have gathered.

Still, despite these criticisms (which, as Mr. Westbury pointed out when describing the i.c. engines, are all for the benefit of other readers as well as the exhibitors themselves), the model really *was* a Marshall, and the rest of the detail work was very good indeed. Diplomas are not awarded for nothing!



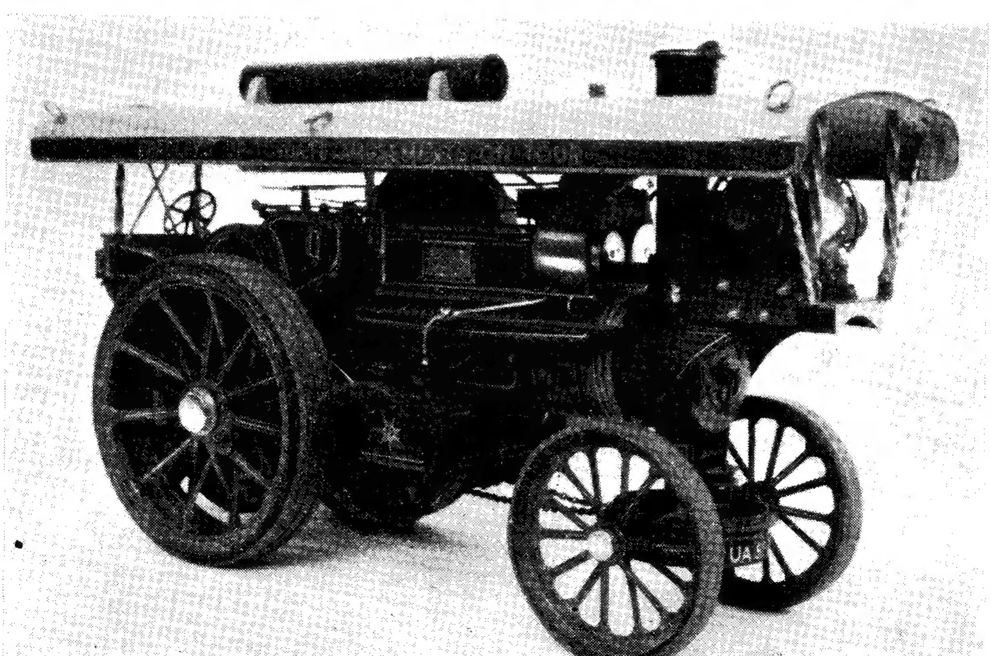
A free-lance 2-in. scale road locomotive with double high-pressure cylinders

A "Commended" diploma was awarded to E. G. Budd, of Worthing, for his 2-in. scale road locomotive. Since this was described as a "free-lance" job, one cannot, perhaps, be too critical of detail, but I do contend that in all *major* points of design even a free-lance engine should follow prototype practice. This means that Mr. Budd was wrong in using double high-pressure cylinders: the engine should have been a compound, or, at least, made to look like one, though the latter is not recommended where the former *could* be achieved, which would not be difficult in this large scale.

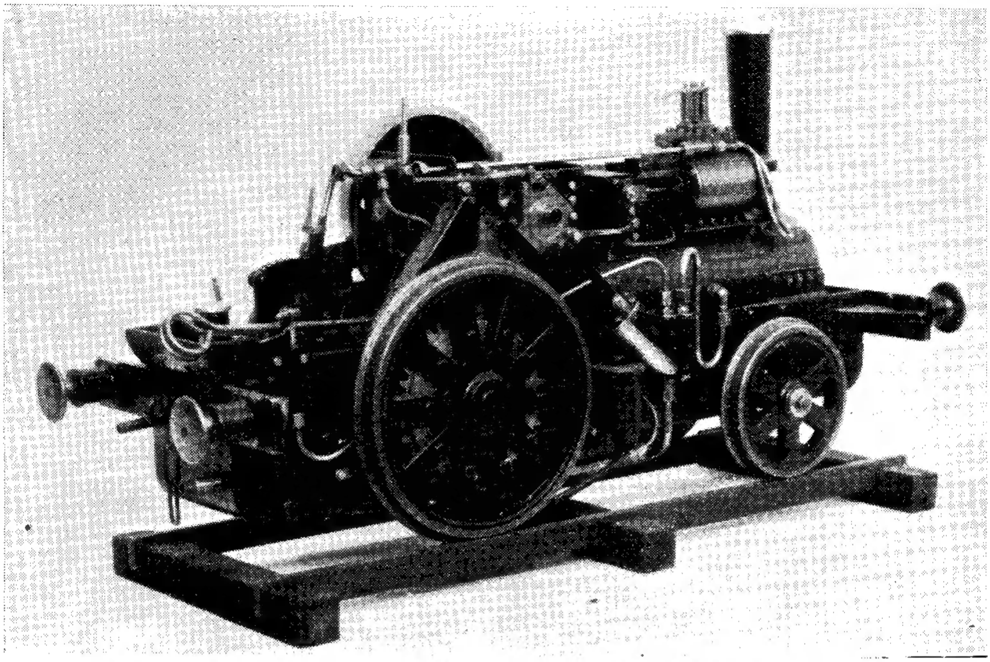
Other points of criticism were the brass worm and wheel of the steerage, the red hose-pipe, unbound with wire, the big-ends without cotters, and the rather heavy slide-bars.

But apart from this, the engine was worthy of its award: the finish was good, with smooth paintwork and neat lining, and such details as the water-lifter, pump, check-valve, lamps, and so on were well carried out. The platework was good also, with neatly riveted gear-case, belly-tank, and tender. I believe this engine is a "first attempt," and as such Mr. Budd can afford to be very pleased with his achievement.

Another 2-in. scale engine, by R. W. Perkins, possessed unorthodox features in having the final drive by chain, and only a single speed,



A Fowler "Big Lion" road locomotive to 1/20th scale, which was shown with other vehicles and a roundabout

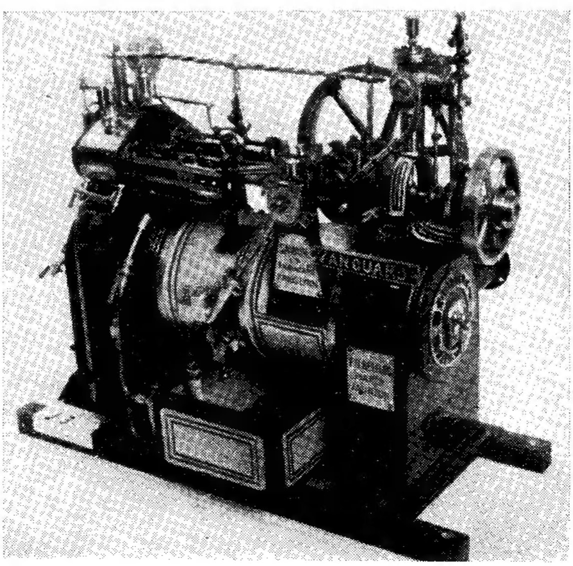


An unusual model in the Loan Section : an Aveling industrial shunting locomotive

neither of which is correct for a road locomotive. Some of the proportions, too, were not correct : compare, for example, the dia. of the steering wheel with the hand-grip of the reversing lever, the former too small and the latter too big. This engine also had the strakes coming right to the edges of the hind wheel rims, which we have discussed in connection with the Marshall, and the steerage chains were much too light.

The general finish was good, however, with a pleasing standard of plate-work ; some of the detail work was *very* good, including the neat oil-boxes and the big-ends ; and I feel sure that this engine might well have received an award of some kind had it not been for the points criticised above.

A very nice little model Fowler "Big Lion" was on view to the unusual scale of 1/20th full size : that is, approximately ⅝ in. to 1 ft. It was built by P. W. Bradley, who is an authority on all types of fairground machinery ; the model was exhibited with a model "Noah's Ark" roundabout and transport vehicles, making a pleasing and realistic display. In building the roundabout Mr. Bradley had been fortunate in the collaboration of N. H. Rainsley, whose superb oil-paintings of animals on the awning and plinth of the roundabout were greatly admired.



Pleasing model of an unusual prototype—Mr. F. G. Bettles' "Savage" roundabout centre-engine

The Fowler is a non-working model, and was built with only the simplest equipment. Nevertheless, Mr. Bradley has "captured the prototype" well, as the photograph shows, and on the whole the detail work matches the general appearance. Incidentally, many readers will remember seeing this model in the Road Transport section at last year's South Bank Exhibition.

The name of F. G. Bettles has become well-known for excellence of

finish, but, frankly, his exhibit this year was not up to his previous high standards; one had the impression that he had "hurried up the job" because of the nearness of the exhibition. In particular, the lining was sadly lacking in neatness, and when one has seen much better work by the same builder, it is a disappointment to see a lower standard.

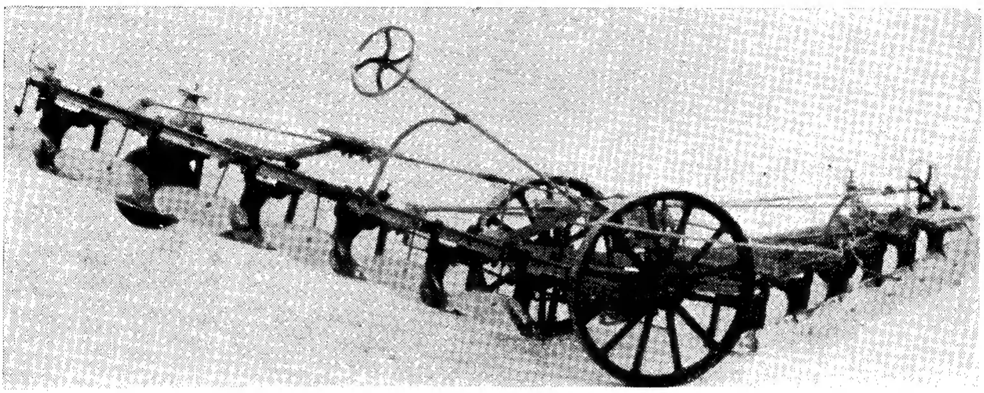
Nevertheless, it was good to see that Mr. Bettles had chosen an unusual prototype. One has to travel far nowadays to see a roundabout driven by a "Savage" centre-engine, with its double high-pressure cylinders with valve-chest between, and its single-cylinder organ engine mounted on the smoke-box. The mechanical details of the model had been well carried out by the builder: the Salter-type safety-valve, the gibbed-and-cottered big-ends, the water-pump, the two governors—all were there, as were the brass trays under the slide-bars to catch the oil-drippings, and the side-flue on the smokebox.

The Aveling Locomotive

Like the centre-engine, the next exhibit to be described is *not* in the traction-engine class, but my excuse for mentioning it lies in its strong associations with the class, both in name and design. It is the Aveling 2-2-0 shunting locomotive adapted from the firm's traction-engine, with a single-cylinder mounted on the boiler top and gear drive to the hind axle. (Other Aveling locomotives had compound cylinders, and some, both single and compound, were fitted with chain drive to both axles.)

The model, in the loan section, was to 5-in. gauge, and appeared as if it had done hard work on the track since it was completed. The sturdy side-frames of the chassis are extended upwards to carry the crankshaft, countershaft, and hind axle; and the boiler, firebox, and water-tank are arranged between the frames. There is a single-speed with a sliding gear, so that the engine can be run as a stationary engine.

Feed to the firebox, which is below the level of the footplate, is by means of a hopper, and there are sand-boxes, with steam-operated jets, in front of the driving-wheels. The cylinder and motion work, are, of course, orthodox "traction-engine," with Stephenson reversing-gear. This was a very attractive, unusual, and satisfying model, and I am sure that Mr. A. E. Tyler, who loaned it, must have great pleasure out of running her.



Still another out-of-the-rut model: a Fowler balance plough as used in steam ploughing

My final photograph, of the Fowler balance plough, is included partly because of its connection with steam ploughing, and partly because I wonder if the builder, R. Palmer, of Southampton, has anything up his sleeve in the way of a pair of ploughing engines for a future "M.E." Exhibition? If so, that would be a sight *well* worth seeing.

Conclusion

From this year's exhibits, and also from my correspondence, it does seem that there is a strong resurgence of interest in the traction engine, and, as Mr. Maskelyne has pointed out, this year the best were better than the best of the locomotives. I hope sincerely that those models now being built, or about to be built, for future exhibitions, will merit the same remark in due course! I would urge, though, that any reader who contemplates building a "free-lance" engine should reconsider his position, especially if he doesn't know much about traction-engines. It is so easy to do something one shouldn't! Of course, one can always make the excuse that it's free-lance, but it's so much more satisfactory not to have to make excuses, isn't it?

Another point is that a good free-lance job can hardly ever be as good, or score as highly, as a good scale model of a prototype. There have been "exceptions that proved the rule" in other fields, but I cannot recall one in this class. And it is possible to have just as much fun—and run into just as much trouble!—in adapting a real prototype to scale, as in starting from scratch with one's own design. I know: I've had some!